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JULY 1919

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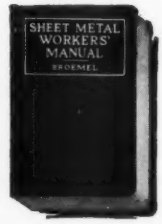

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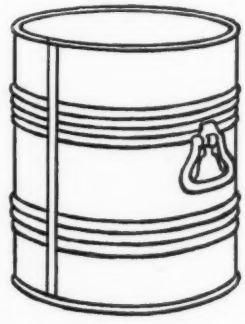


PEXTO

SHEET METAL WORKERS' MACHINES & TOOLS

INDUSTRIAL-ARTS MAGAZINE

Vol. VIII JULY, 1919 No. 7

EXPERIMENTAL WORK IN JUNIOR-HIGH SCHOOL INDUSTRIAL ARTS

A. H. Edgerton, The Lincoln School of Teachers College, Columbia University, New York City

RECENT investigations clearly show that tradition, rather than present-day need, still too largely determines the purpose, content, and method of the industrial subjects in the seventh, eighth and ninth years. Nevertheless, the rapid developments in intermediate schools, junior-high schools, and similar reorganized work in other schools are so many evidences of a serious attempt to prepare our pupils for efficient service and more intelligent citizenship. Today, as never before, it is evident that the larger values in industrial-arts education can not be realized alone from the mere doing and making of things, where skill in the manipulation of materials, tools and machines is the main objective. If the industrial-arts courses are to occupy an important place in the program for general education, is it not reasonable to expect them to share the responsibility for helping boys to develop perspective and thinking power in connection with real life situations? The importance of skill and knowledge should be fully recognized as a factor in general education. However, should not these be vitalized thru those concrete experiences which will stimulate thought and actually make a difference in the lives of our pupils as members of families, of vocational groups, and of various civic groups?

Some of the current problems confronting those responsible for developing industrial arts for pupils of the upper grades are comparable, to a degree, with those which at one time confronted the business and industrial systems in this country. In 1880, when Dr. Frederick Taylor and other pioneer efficiency engineers began their work, and for years afterward, those of our industrial problems which might be characterized as mechanical were solved by opinion and "rule of thumb." As a result of scientific investigation, those methods which were based almost entirely upon opinion have given way to methods based upon fact. There is likewise an increasing need for scientific investigation in connection with the various industrial activities in order that we may determine *what* and *how* our junior-high school pupils can learn most effectively and economically.

A Promising Type of Industrial-Arts Organization for the Seventh, Eighth and Ninth Years.

It is not difficult for us to accept this well known theory that our practices should not be based chiefly upon opinion, which is naturally variable, but upon established fact. On the other hand, it is obvious that at the outset we must often be satisfied with our best opinions, based upon the most feasible applications of existing educational theory, until our practices have become common enough to give a reasonable basis for worth-while experimentation.

Allow me to illustrate this by drawing freely from that experience with which I am most familiar. As many of you have also discovered as a result of first-hand experience, a large number of difficult problems confront the teacher who conscientiously undertakes to select, organize, and offer industrial activities to meet the needs of a definite group of junior-high school pupils. In this particular case, the accepted policy of our whole junior-high school organization was that "essentially required courses be given, for the purpose of giving valuable contact with different types of world knowledge and with interesting and profitable activities; and that such courses serve as the basis for purposeful election of courses in the senior high school; but that individual students be permitted to discontinue sequences of courses and substitute others, with the permission of their advisers." My immediate problem was to provide, as best I could, a sufficient number and variety of representative industrial activities to try out, discover, and develop any ability for understanding, doing, and managing industrial work.

Because of the added advantages in having a great variety of materials, tools and machines available in one room for immediate use, and also because of the greater opportunity for observing many distinct types of construction work, a general workshop plan was developed in preference to a number of separate, specialized shops. Altho the equipment, the materials, and the technique were all chosen from important industrial pursuits, the recognized purpose of the work and study was not primarily to produce skilled workers for definite vocations but rather to help all pupils, regardless of their social standing and possible life work, to develop industrial intelligence and thinking power in connection with real life situations. The manual aspects of the work and the studies of conditions and processes in present-day industry included various types of concrete experiences selected from such occupational pursuits as printing and publishing, carpentry, cabinet and furniture making, pattern making and foundry, sheet metal, forging, machine shop, concrete, general construction and repair, and the like. The problems or projects taken up in each

one of these activities usually resulted in serviceable and useful products. Proper consideration was also given to the kinds and qualities of materials, the appropriate design and construction, the processes of manufacture, the applied mechanics, physical sciences and mathematics, and the industrial history and civics as these related to the study at hand. Three hours weekly during each of the seventh, eighth and ninth years seemed a reasonable amount of time for the following essentially required industrial arts activities:

Seventh Year. Carpentry, elementary cabinet and furniture making, concrete construction, elementary metal work as needed in wood constructions, and the related drawings were offered during the seventh year. I might mention that, altho considerable freedom of choice has always been allowed in each of these activities, it is ordinarily required that all pupils complete the minimum requirements in each before the end of the year; however, this does not necessarily mean that a pupil must finish all of the requirements in one kind of work before taking up work in another. While working drawings were frequently made as these related to the various construction problems, the reading of drawings rather than technique in making them was the chief emphasis during this year.

Eighth Year. Printing, machine shop, forging, pattern making and foundry, construction related to general science, general construction and repair, and drawing were offered during the eighth year. As in the seventh year, industrial methods used in productive industry were studied first-hand, if possible, where these could not be duplicated because of our limited shop conditions. The related drawing was continued during this year with more technical emphasis, making it possible for all pupils to express ideas of construction accurately in addition to obtaining the necessary information from drawings and blue prints.

Ninth Year. As a result of the variety of samplings in the seventh and eighth years, interests and abilities usually become sufficiently evident by the ninth year, both in positive and negative way, so that some pupils take more intensive work in activities already started while others investigate new activities or experiment with selected problems. Greater emphasis was given to technique and related technical information in all activities, including mechanical drawing, in this year. Careful studies were also made to give a better appreciation of economic production and the proper attitude toward work and workers in each industry. These studies of occupations and related economics included such considerations as importance of trade, health conditions, needs, qualifications, wages, opportunities, conditions of employment, and the like. In addition to the general purpose of this year's work, it is possible for a "try out" activity to become more specialized to meet the individual needs of any who of necessity must leave school at this time. Such special work is considered a preparation for vocational work rather than as strictly vocational training, until definite cooperation with an outside industry takes place.

A Definite Need for Experimentation.

As soon as the work was fairly well established, the need for experimentation along the lines of economy of time and economy in method became apparent. At the outset numerous methods had been chosen which, as a result of limited experience, seemed to be most suitable and promising for carrying out our objectives. On the other hand, the result of an investigation made it quite clear that several of our practices differed materially from those used in other upper grade workshops. If only for this reason, it would have seemed desirable to make objective studies to ascertain facts in preference to basing our conclusions entirely upon opinion; however, I was conscious of a more immediate need for such experimentation.

It had seemed desirable from the very beginning that all problems or projects undertaken in each activity should result in serviceable useful products rather than in abstract exercises. Altho certain minimum requirements in the form of definite types of work and study existed in each division of the industrial arts, as has already been mentioned, these were made flexible enough so that a pupil might either choose one of several jobs at hand or he might substitute one of equal difficulty, as frequently happens in connection with home or outside work, especially when the pupil has facility for doing a good job. At any rate, the doing of a real job was the pupil's main interest and concern. It is true, for example, that before a boy can make a chain for any purpose, he must first be able to build and care for his forge fire, get the right heat, bend the iron properly, scarf and weld it; however, all of these operations are not so many deadening exercises for the boy who is truly interested in the making of the chain but quite necessary means for accomplishing his main objective. (This is not a defense of chain-making, involving much repetition of the same processes, as a means of general education for junior-high school boys; altho it is used here as an illustration of the fact that normal boys from 12 to 15 years of age have more natural interest in the doing of worth-while jobs than in the doing of formal operations or processes as ends in themselves.)

As the result of almost daily observation, it had seemed that those boys, who were allowed considerable freedom in choosing useful jobs in terms of minimum requirements, not only showed much greater interest and did better work but also used less time in doing it than those who occasionally were arbitrarily given abstract work of a similar nature. Judging from these tentative observations, it seemed quite probable that in the former case the boys were especially concerned with the doing of the job itself, while in the latter case they were chiefly occupied with the doing of the operations or processes as ends in themselves. In this connection,

figures which were gathered with the help of summer school students at Columbia University, relating directly to 7,389 seventh and eighth year pupils in 379 progressive schools in different sections of the country, show that over 78 per cent of these selected schools place the main emphasis upon the doing of operations or processes without respect for the needs and interests of their pupils.

Results of Comparative Studies in Several Activities.

The first opportunity for beginning this experiment presented itself in printing. As an introduction, it might be briefly stated that each one of the sixteen boys who took part in this experiment had gained a good understanding and some skill in composition, stone work, proof-reading, and correcting, making up forms, press work, distribution, and the other important processes typical of the print shop, during the first nine weeks of the course. The semi-commercial work, which these boys participated in during this period, consisted of the printing of cards, programs, tickets, and straight matter at first; while later the artistic arrangement of headings, spaces and lines was applied to the printing of announcements, bulletins, school publications, etc. When this experiment was begun the class was about to take up simple problems in color work and make related studies of commercial methods in modern printing and publishing plants.

Before starting the sixteen boys, they were divided into groups "A" and "B," each group being composed of eight boys having equal ability, as nearly as could be judged from their previous work in printing. Each boy in Group "A" was presented with typewritten manuscript for four printing problems of about equal difficulty in the setting of straight matter. The directions for doing the work in each case were clearly but briefly stated. A simple statement of the use which would be made of each job when delivered was also included. Before distributing these, it was explained verbally that each boy was allowed to choose one, and only one, of the four jobs given to him, and also that each finished product was needed just as soon as we could complete it. In starting Group "B" the next time it reported for work, each one of the eight boys was given identical directions which had been given to the corresponding members of Group "A," and also the same kind of manuscript with the exception that this time the sentences were so changed in order that the assignments could not be recognized as being other than abstract exercises. To Group "B," it was stated that each boy would receive a manuscript to be used as an exercise for finding how long a time it would take him to set up, proof-read and correct it. It was previously arranged so that each boy in Group "B" was paired off with a boy of as nearly corresponding ability as possible in Group "A." While the boys in Group "A" were all working on much needed jobs, the boys in Group "B" were doing exactly the same kind and amount of straight matter with the emphasis upon the processes involved.

In comparing the final proofs of Group "A" and Group "B," it was quite noticeable that each boy who did the composition, proof-reading and correcting as a means to an end, rather than an end in itself, did more accurate work. As might be expected, it was also evident that the boys in Group "A" were much more interested in their problems thruout the experiment. They seemed to put good thought back of their work and carried out their jobs in a systematic and businesslike manner, which was not paralleled by the boys in Group "B." As a result, the members of Group "A," both collectively and individually, occupied much less time in doing their jobs. With the help of the students, I was able to keep an account of the time which each spent upon his piece of work. The boys in Group "A" finished their respective work in 39.7 per cent less time than it

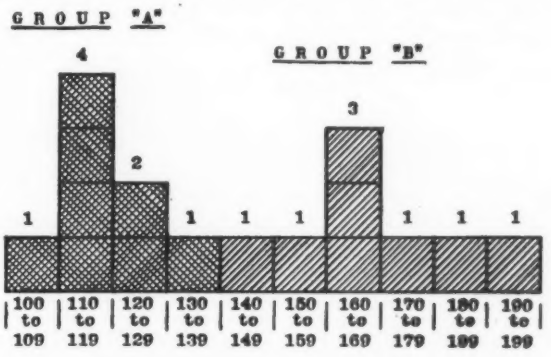


Fig. I. Graphic Representation of Data from First Printing Experiment. Horizontal distances represent number of minutes required; vertical distances represent number of boys.

took the members of Group "B" to complete theirs. The percentage of time saved by any one individual in Group "A" was neither greater than 53.2 per cent nor less than 27.8 per cent. A graphic representation of the frequency table for this experiment is shown in Fig. I.

Since the number of pupils involved in this experiment was necessarily limited, it seemed desirable to carry the experiment still further in printing before drawing definite conclusions. In order that there might be some variation in the pupils' work, it was decided to base the second experiment upon the setting up, proof-reading and correcting of simple display matter instead of straight matter. The boys were grouped as before, but this time the order was reversed so that each boy in Group "B" was presented with typewritten "copy" for four display jobs, from which he chose one; while each corresponding boy in Group "A" was given the same "copy" in changed form for use as a speed and accuracy exercise. The directions and methods in this second experiment were essentially the same as those explained in connection with the first experiment. With the order reversed in this second experiment, the boys in Group "B" were now allowed a limited choice of useful jobs; while the boys in Group "A" were given the same kind

and amount of display matter with the chief emphasis upon the doing of the printing processes.

When comparisons were made, it was found that the results of this experiment were much the same as those of the first experiment, with the exception that the difference between the groups was not so great this time. A careful comparison of the final proofs showed clearly that each boy in Group "B" had, without exception, done more accurate type-setting, proof-reading and correcting than had the boy in Group "A" who was matched with him. In this experiment, the boys in Group "B" did their respective jobs in 33.9 per cent less time than it took the boys in Group "A" to finish theirs. Each member of Group "B" required much less time than was needed by the corresponding Group "A" member to do the same kind and quantity of work. The time saved by individuals in Group "B" ranged from 22.6 to 45.5 per cent, respectively, for the smallest and greatest gains. Fig. II shows the frequency surface of the data for this second experiment in printing. Altho

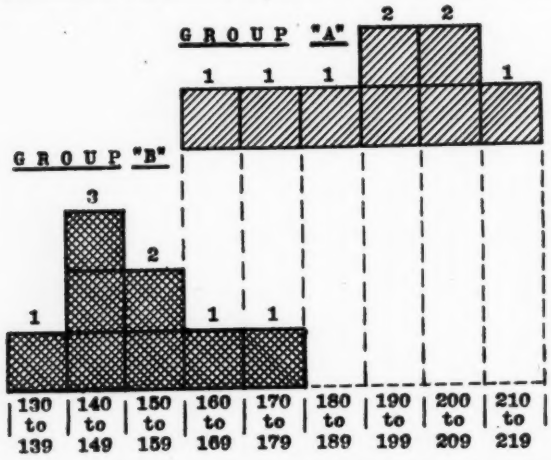


Fig. II. Graphic Representation of Frequency Table for Second Experiment in Printing. See Fig. I for explanation of frequency surfaces.

it was impossible to record a definite measurement of the interest which each showed as he went about his work, a decided change came over each boy during the second experiment. In fact, about the same amount of interest which was credited to members of Group "A" in the first experiment was evidenced by the Group "B" members in this experiment. Much to my surprise, the members of Group "A" seemed no longer able to meet and make the most of situations which arose in their work, altho this had characterized their work thruout the first experiment.

Each succeeding comparison re-emphasized the fact that by reversing the groups, as a check on the first experiment, we had gained results comparable to those recorded during the first experiment. It is fully realized that these data on the results of either experiment are erroneous to a degree measured by the exact difference between the abilities of these two groups. However, this does not hamper the conclusions on the outcome of these experiments. The boys in Group "B," who were mainly concerned with printing processes during the first experiment, were especially interested in the doing of worth-while jobs during the second experiment, and vice versa; therefore the results of the second experiment acted as a check for any differences which may have existed between the groups during the first experiment.

Before giving conclusions based upon the results of these two experiments in printing, it might be well to briefly mention the results of similar experiments in this series which were later carried out in woodworking and metalworking activities. The results of the experiments in printing were so promising, it seemed desirable to extend this particular experimental work to selected problems in the fields of carpentry, furniture making, machine shop, sheet metal, and forging in order that we might, if possible, replace general opinion of certain practices, based almost entirely upon observation, by fact.

The need in our school for several shower drainboards, involving the making of end-lap joints, and also for a number of bulletin boards, involving rabbeting and the making of mitre joints, gave an early opportunity to try out these same inferences upon eighteen boys who had had considerable elementary experience with hand woodworking tools. The plan and method used for the following experiments were, with certain necessary adaptations, essentially the same as those used in the print shop experiments. Considering the marked difference between these two activities, the general interest shown and the quality of the work done were not greatly different from the outcome of the printing experiments. In fact, even a larger percentage of time was saved in both woodworking experiments by the boys who worked upon useful jobs rather than upon the abstract work. This probably was partially due to such new considerations as waste in material, amount of accuracy involved, and the elimination of unnecessary slowness which did not figure in the printing experiments. In the first experiment, Group "A" finished its work in 42.3 per cent less time than was taken by Group "B"; while, in the second experiment, Group "B" completed its work in 31.8 per cent less time than was required by Group "A."

Altho the experiments in sheet metal and forging, both involving the use of hand tools, gave results similar to those just stated as the outcome of comparisons in woodwork, the experiments with the engine lathe in the machine shop series involved several entirely new elements which made less variance between the work of the groups. The problems selected for the first and second experiments consisted, respectively, of cylindrical turning and taper turning on centers. Because the engine lathe, when once set up, did the work more or less mechanically, and also because of the similar amount of accuracy required of each boy in this particular type of metalwork, the difference between the groups, as already suggested, was naturally less in every respect.

For example, in the making of cylindrical pieces Group "A" did its work in 19.8 per cent less time than it took Group "B," while in the taper-turning experiment Group "B" did its work in 16.5 per cent less time than Group "A" required.

General Conclusions on Results of Experiments.

Because of the similarity and accuracy of these results, it would seem that the psychological and sociological needs and interests of boys from 12 to 15 years of age are mainly in real productive work, rather than in series of exercises, models, pieces, or whatever else you may care to call them. Because of their natural interest in industrial things, boys of this age can be required to make series of formal models or exercises without much resistance; however, to thus take considerable time in overemphasizing skill in the use of materials and tools means a great sacrifice of the larger values in the work. The results of each one of these experiments make it seem evident that any values which exist in such formal courses can be retained and given greater emphasis where the boy's main objective is the doing of a useful problem, project, or job instead of a formal exercise, operation, or process. More important still, a large percentage of time is thus saved for helping pupils to develop industrial intelligence and thinking power in connection with real life situations. While there are tentative types of profitable experiences which all pupils should undoubtedly have in each organized industrial activity, the minimum requirements for these might well be made sufficiently flexible so that each pupil can be allowed some freedom in choice, as well as experimentation.

In most upper grade curricula, the time allowed for the industrial arts is entirely too small, consequently any desirable changes in organization, which can also result in a saving of time, should make possible the addition of other typical industrial activities besides woodwork, which unquestionably offers somewhat limited possibilities for getting concrete experiences and studying present-day industry. The teacher of industrial subjects is today confronted with increased responsibilities because of a new conception which our whole country has gained of the practical side of education and education for service. Therefore, any reorganization in existing industrial courses or introduction of constructive methods, which will help our pupils to learn more effectively and economically, will likewise help the progressive teacher to meet his greater obligation.

FOOT-POWER LOOM WEAVING

Edward F. Worst, Supervisor of Elementary Manual Training, Chicago, Ill.

NOTWITHSTANDING the introduction of the power loom and all its wonderful possibilities, the hand loom still survives and seems likely to continue in use since numerous schools and handicraft societies as well as many independent art workers are becoming interested. This gives hope that at some time in the near future the domestic occupations of weaving and spinning in both flax and wool will again find a place, not only in the home but also in the studio and in the industrial school. The appreciation of handwork has, during the past decade, increased in the estimation of the public.

In various European countries, as well as in India, China and Japan, hand loom weaving still continues. In Norway and Sweden a very successful line of home industry is carried on to great advantage to many women who find it necessary to aid in the family support. This may also be said of the women in the Orkney and Shetland Islands.

Of late much has been written of the beautiful hand-weaving done by the women in the mountains of Kentucky and Tennessee. So attractive is this work that little difficulty is experienced in disposing of the articles woven.

Since the introduction of machine spinning and weaving, no home industry which approaches them in usefulness or interest has taken their place. It is true that there are many lines of weaving now produced by the machine, too intricate to be attempted on the hand loom; but the weaving of linen, cotton, woolen and the coarser silk threads into materials of strength and beauty for home use, can quite well be carried on in the studio and even by the homemaker who has other household occupations.

Those interested in weaving are often confronted with various questions concerning the value of foot-power loom weaving. Does the work have an educative value? Does it pay commercially? Why go backward in these progressive times?, etc.

The writer well remembers a visit, a few years ago, to a large Eastern woolen mill, in which many women were employed. The attendants in charge of power looms who in most instances were women, were engaged in a monotonous toil in which no quality but intense watchfulness was required. So mechanical was the work that each woman seemed a part of the machine. So great was the clatter of machines that one could not carry on a conversation. Not so with the weaver of a foot-power loom who is employed in a pleasant, ingenious occupation which exercises all her faculties. She has the joy of working in her own home, enjoying the glorious sunshine, the trees, grass, flowers and singing birds about her own door yard.

The handling of beautiful materials in various colors has a most wholesome effect upon the work. It is difficult to understand how any one operating a foot-power loom can entertain any but the very best thoughts.

If the operator is a mother and obliged to support the family wholly or in part, her presence in the home aids greatly in making better girls and better boys and eventually better men and women of her children.

This alone is quite worthy of consideration. So greatly is handwork appreciated that the earning capacity of the home worker is equal to, if not greater than that of one who works in the mills.

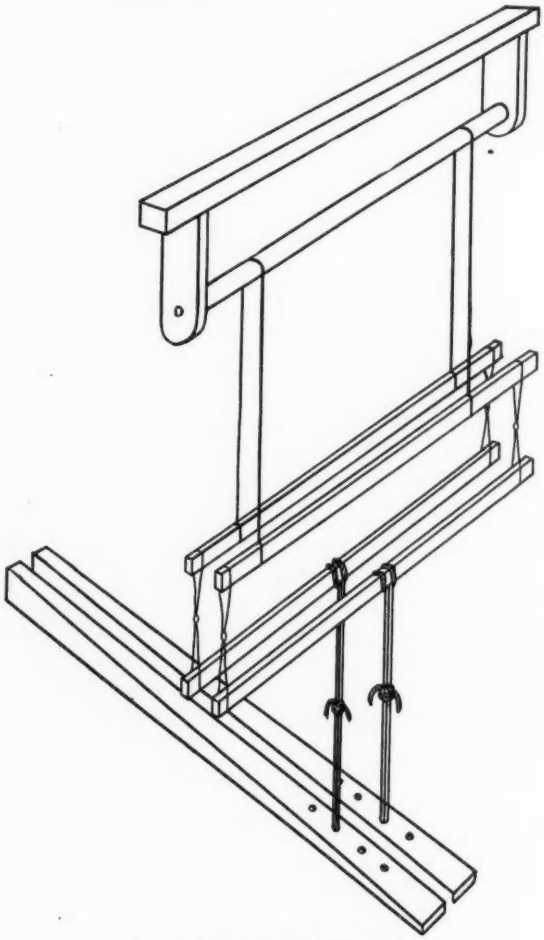


Fig. 1. Two Sets of Harnesses in Use.

Educationally the loom should have a place in every department of our public schools to be used for demonstration purposes. Very few pupils have any idea of the composition of a piece of cloth. The wide awake, progressive teacher will plan her work so that each pupil under her supervision will at some time during the year, not only hear about, but will see, the processes a piece of linen passes thru from the tiny seed to the finished piece of cloth. The same may be demonstrated with wool, silk and cotton. When this is done the subject becomes a real live one and no longer remains in theory only.

The Foot-Power Loom.

Any number of looms may be found scattered thruout the country. Of late years these looms have been used principally in the weaving of rugs and carpets, using rags. Pattern weaving except in a very few sections of the country has become almost extinct.

To most amateurs the pattern weaving appears so complicated that they hesitate to undertake the work.

Simplicity of Patterns.

Any foot-power loom may be made to weave patterns. The only change necessary is to add two more treadles making four in number.

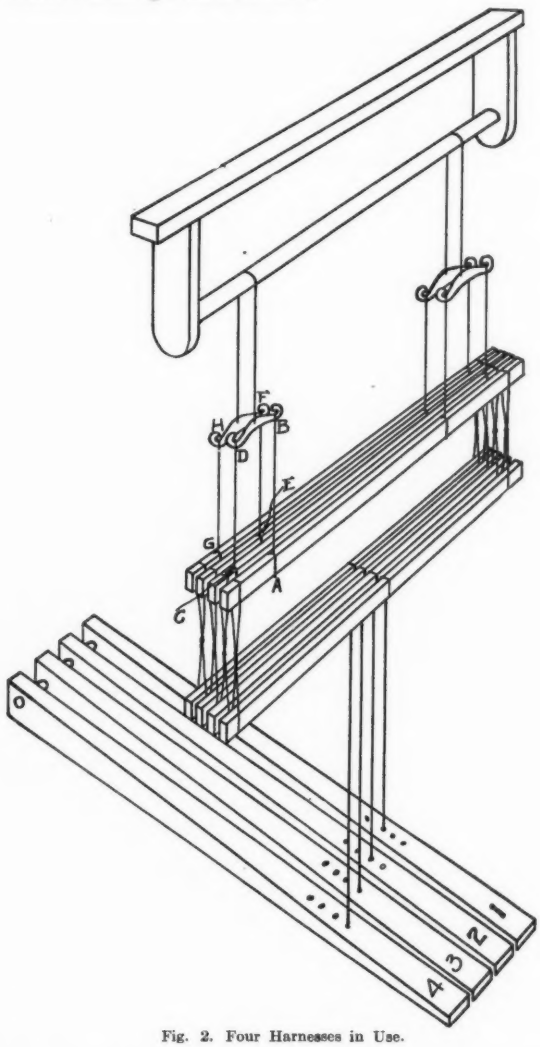


Fig. 2. Four Harnesses in Use.

In carpet and rug weaving only two sets of harnesses are used, each lower heddle stick being tied to a treadle, as shown in Fig. 1.

In pattern weaving four harnesses are used, each lower heddle stick being tied to a treadle, as shown in Fig. 2.

Heddle Horses.

In order that each of the four harnesses may work separately the upper heddle sticks are tied to the heddle horses as shown by the lettering in Fig. 2, B to A, D to C, F to E, and H to G. The drawing for the heddle horse is shown in Fig. 3. Either kind answers the purpose.

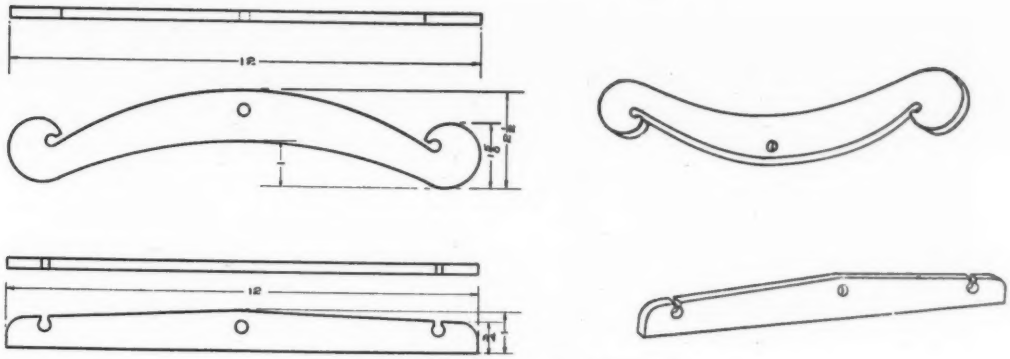


FIG. 3. DETAILS OF HEDDLE HORSES.

Threading of Pattern.

"Draft" is the term usually applied to a threading as shown in Fig. 4. This, when properly followed, produces the pattern as shown in Fig. 5. "The Big Diamond" is the particular name of this pattern.

First: Each dark square indicates a thread. In threading a pattern always begin to read at the right. When the first part is finished begin at the right of the second and then the third, etc.

Second: The pattern begins with the first thread after the right selvage and ends with the last thread before the left selvage.

Supposing the warp is on the beam and the "drawing in" or threading is to begin.

The right selvage is threaded first. The bracket with 2X beneath indicates that all within the bracket is to be repeated two times. The first thread is drawn thru the first heddle on the fourth heddle stick. The second thread is drawn thru the first heddle on the second heddle stick. The third thread is drawn thru the first heddle on the third heddle stick, the fourth thread is drawn thru the first heddle on the first heddle stick. The fifth thread is drawn thru the second heddle on the fourth heddle stick. Continue with the sixth, seventh and eighth threads. When this is done begin at the beginning of the selvage and thread again. Each group of threads within a bracket is repeated in this way, repeating as many times as is indicated by the figure below it.

The pattern is now threaded until the left selvage is reached. From this place the threading begins at the beginning of the pattern and is repeated a second time straight thru to the left selvage. The second time completed, the pattern is threaded a third time up to the place marked by the arrow. The left selvage is now threaded twice.

The threading completed, the threads are drawn thru a No. 15 reed, two to each dent in the pattern and four selvage threads in each of the first four dents. The same for the left selvage.

The loom is now tied up as shown in Fig. 2.

Weaving the Pattern.

One who understands a draft is able to read the whole story of the pattern in it. The threading having been done and the loom tied up the pattern is ready to be woven.

The plain weaving for the pattern shown in Fig. 4 is done by pressing down treadles 1 and 2 at the same time for one-half the threads and treadles 3 and 4 for the other half. Weave in about one inch of plain weaving by pressing down treadles 1 and 2 and 3 and 4 alternately.

The first two threads of the pattern are drawn thru heddles on the second and third heddle sticks. This means that treadles 2 and 3 are pressed down at the same time and a pattern thread is passed thru the shed from the right to the left.

The shuttle doing the plane weaving is also at the right. After the pattern thread has been beaten in place treadles 1 and 2 are pressed down at the same time and a plain thread is passed thru the shed. This thread is called a binder because it binds or holds the pattern thread in place.

Both shuttles are now at the left. Treadles 2 and 3 are again pressed down and the pattern thread passes thru the shed or opening. When pressed in place, treadles 3 and 4 are pressed down and the plain thread or binder is passed thru the shed.

Each black square on the draft represents a pattern thread. After each pattern thread a binder or plain thread is woven.

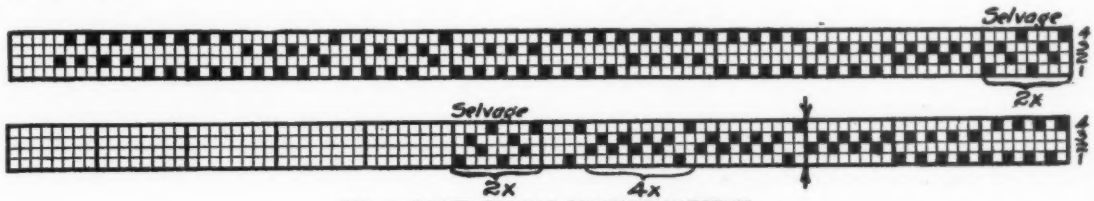


FIG. 4. DRAFT FOR BIG DIAMOND PATTERN.

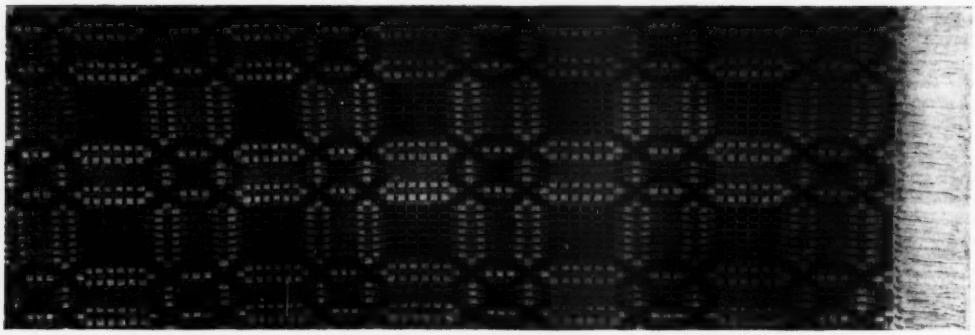


FIG. 5. BIG DIAMOND PATTERN X.

It will be observed that the threads in any draft seem to come in pairs. In this particular draft the pairs in their order come, first, 2 and 3 four times. The second combination is 1 and 3 four times. The third 1 and 4 four times. The fourth 4 and 2 four times, etc.

This means that treadles 2 and 3 are pressed down for the first color threads. The next 2 and 3 are pressed down at the same time; the next 1 and 4 are pressed down at the same time and the next 4 and 2.

The Binder.

It has already been stated that a plain or binder thread is woven in after each color thread. Great care must be exercised in having this plain thread come from the right side. In the draft at hand it was found that the plain weaving is done by pressing down first treadles 1 and 2 and then 3 and 4.

The pattern thread may come from either side.

For the amateur it might be well to say, that when the shuttle doing the plain weaving is at the right side the outside right treadle is pressed down together with the other treadle that must go with it. This other treadle in this particular draft is No. 2. When the shuttle doing the plain weaving is at the left side, the outside left treadle is pressed down together with the one that must accompany it, which in this case is No. 3.

If this device is kept in mind there will be no difficulty in knowing just which combination is to be pressed down for the plain weaver or binder.

Since each dark square represents a thread each combination must be pressed down as many times as there are dark squares in the combination. Combination 2 and 3 appears first four times. Since there are eight dark squares it means that the combination of 2 and 3 must be pressed down eight times.

If any combination appears but once it means that since there are two dark squares in the combination it must be pressed down twice. No attention is paid to the selvage threads as these are cared for when weaving the pattern.

It must be remembered that when four treadles are used two must be pressed down at the same time. There are always six combinations of treadles and harnesses. In this particular pattern they are 2 and 3, 3 and 1, 4 and 1, and 4 and 2 for the pattern and 1 and 2, and 3 and 4 for the plain weave.

Four Harness Loom and Six Treadles.

To most amateur weavers the lambs, or treadle helpers, as they are sometimes called are somewhat confusing. While the lambs are not absolutely essential in pattern weaving they aid greatly.

The lambs are the four levers placed just below the lower heddle sticks as shown in Fig. 6.

If your loom was built without them there is no

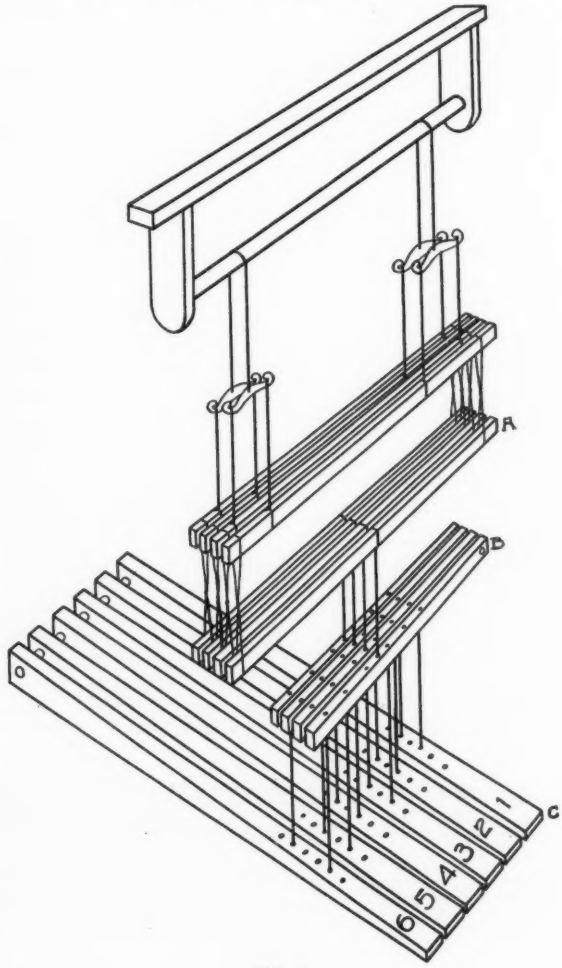


FIG. 6.

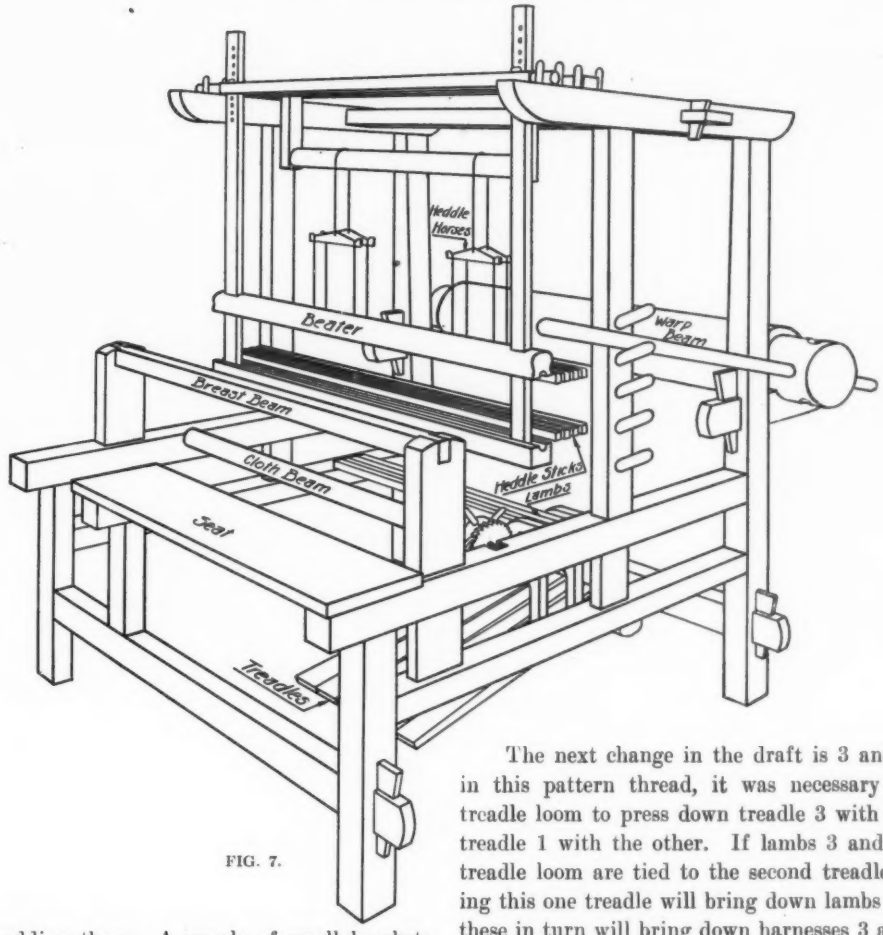


FIG. 7.

difficulty in adding them. A couple of small brackets of wood are screwed to the inner side of the right side of the loom. A hole is placed in each bracket. A hole is bored at the end of each lamb. An iron rod on which the lambs have been placed holds them between the brackets as shown at B, Fig. 6. Fig. 7 shows the completed loom and the exact position of the lambs. With the help of the lambs each treadle draws down two harnesses.

Tie-Up Using Lambs and Six Treadles.

Fig. 6 shows each lower heddle stick tied to a lamb.

A series of holes is bored in each lamb. It is readily understood that each time a lamb is pulled downward it brings with it a harness. In other words, lambs and harnesses work together. If two lambs are tied to one treadle it means that when that treadle is pressed downward it brings not only the lambs down but also the harnesses.

Going back to the draft shown in Fig. 4 the first pattern thread was woven in on the four treadle loom by pressing down treadles 2 and 3 at the same time, making it necessary to use both feet. If lambs 2 and 3 in the six treadle loom are tied to the first treadle then pressing the treadle will bring down lambs 2 and 3, and these in turn will bring down harnesses 2 and 3, because each harness is tied to a lamb.

The next change in the draft is 3 and 1. To put in this pattern thread, it was necessary in the four treadle loom to press down treadle 3 with one foot and treadle 1 with the other. If lambs 3 and 1 in the six treadle loom are tied to the second treadle, then pressing this one treadle will bring down lambs 3 and 1, and these in turn will bring down harnesses 3 and 1. When lambs are used six treadles are required, four to be used for the pattern and two for the plain or tabby weave.

For convenience the two middle ones are reserved for the plain weaver, skip the two middle ones and pass on to the fifth. To this fifth treadle lambs 1 and 4 are tied, and to the sixth tie lambs 4 and 2.

The two middle treadles being reserved for the plain weave lambs 1 and 2 are tied to the right middle treadle No. 3, and 3 and 4 are tied to the left middle treadle No. 4.

Weaving the Pattern.

Weave about one inch of plain cloth before beginning the pattern. This is done by pressing down treadles 3 and 4 alternately, passing the plain thread thru the shed each time.

It always requires two shuttles to do pattern weaving, one for the colored thread and one for the binder. With both shuttles at the right, press down the first treadle which draws down the lambs 2 and 3. Lambs 2 and 3 have been tied to the lower heddle sticks 2 and 3. So heddle sticks 2 and 3 must be pulled down when pressure is applied to treadle one. A colored thread is now passed thru the shed and pressed or beaten in place. The shuttle for plain weave being at the right side, the right middle treadle (No. 3) is pressed down bringing

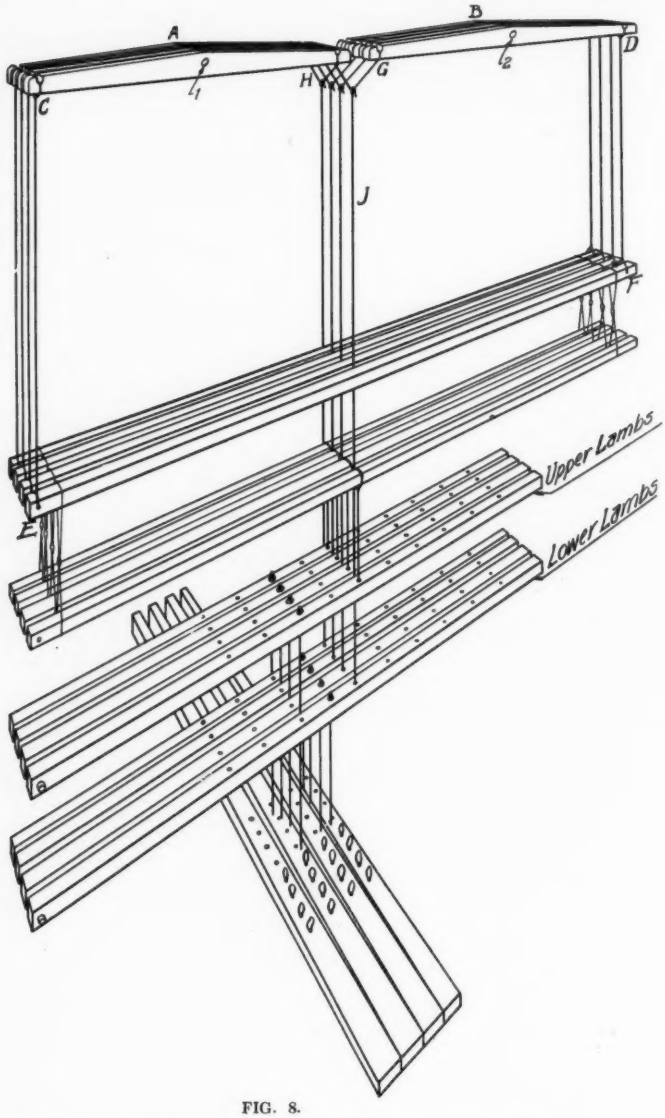


FIG. 8.

with it heddle sticks or harnesses 1 and 2. The plain thread or binder is now passed thru the shed.

Treadle 1 is again pressed down and a pattern thread is passed thru the shed. The shuttle doing the plain weave is now at the left so the left middle treadle (No. 4) is pressed down and the binding thread passed thru the shed. Treadle one is again pressed down and a third pattern thread is passed thru the shed. The plain thread shuttle is now at the right, so the right middle treadle is pressed down and a binder thread is passed thru the shed. It will be observed that when the plain shuttle is at the right the right middle treadle is pressed down and when the shuttle is at the left the left middle treadle is pressed down.

The pattern shuttle way comes from either the left or the right. By following the latter tie-up it is necessary to use six treadles but only one foot at a time, thus making it possible to accomplish a greater amount of work in a given time.

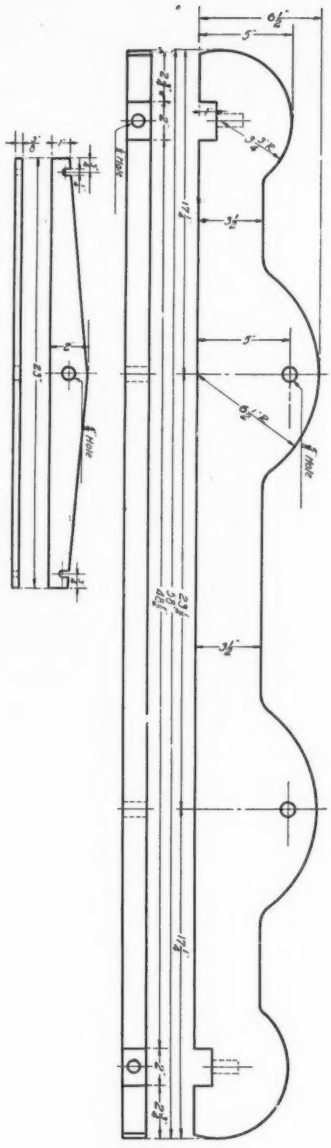


FIG. 9.

Another Way of Tie-Up.

The writer has tried out all the different "tie-ups" on a single loom by having the various additional parts constructed after the original loom was built for two treadles and two harnesses.

The drawings in Fig. 8 and Fig. 9 show an over-head arrangement for handling either an odd or even number of harnesses. The parts from which the harnesses hang in the original loom are removed and the construction shown in Fig. 9 takes its place. When this over-head arrangement is made use of, two sets of lambs are used and arranged as shown in Fig. 8.

The position of each additional part is shown in the assembled loom, Fig. 10.

The two sets of lambs may be seen to the right just below the harnesses. Instead of brackets holding the lambs they are placed in a sort of frame having holes

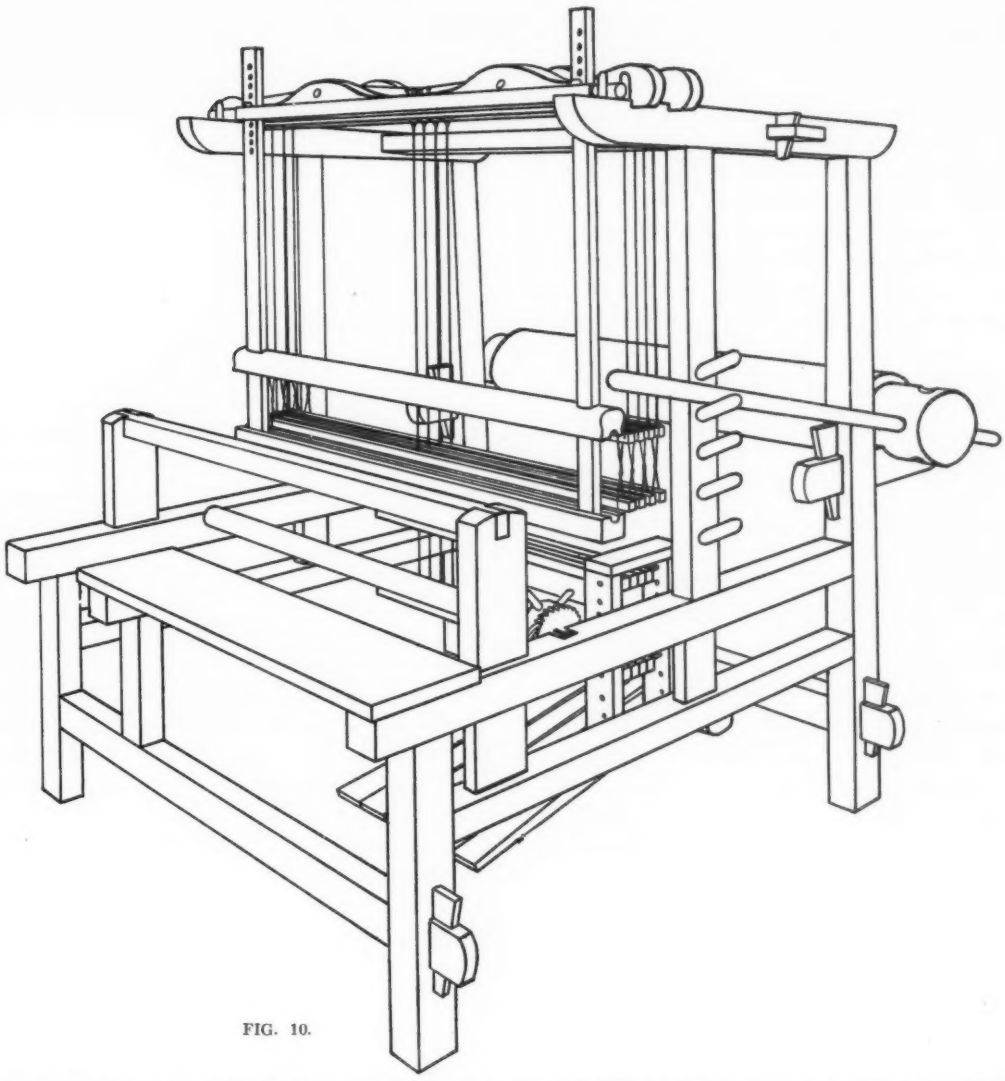


FIG. 10.

bored along the sides. Quarter inch iron rods are used to hold the lambs in the frame. When two sets of lambs are used the loom should be about four inches higher. This may be done by dowelling four-inch blocks to the upright parts of the loom.

If an eight-harness loom is desired sixteen pieces are constructed as shown in the smaller drawing, Fig. 9. Eight of these are placed to the right upper half of the loom and the other eight to the left upper half, Fig. 8. The various sections are held in place by a half inch dowel rod as shown at 1 and 2, Fig. 8.

Loops of No. 16 blocking cord are tied and hung from each outer end of the levers as shown at C and D, Fig. 8. These ends are then fastened to each end of the upper heddle sticks as shown at E and F. From the inner ends of the levers H and G, a piece of blocking cord is tied, one end to one and the other end to the other, Fig. 8. From each loop a piece of blocking cord extends to the lower set of lambs by passing between the harnesses, and ties to a corresponding lamb. This takes care of the lower lambs. Each upper lamb ties to a lower heddle stick, the same as in each of the other looms already described. Loops of blocking cord are now drawn thru the holes in the treadles, one in each. The upper lambs are tied to the treadles the same as in every other "tie-up," the cord passing between the lower lambs. The lower lambs are also tied to the treadles by using the loops not used in tying the upper lambs.

By tying a loom in this way all harnesses making the pattern are drawn down while the other harnesses are drawn up. No part remains stationary.

Fig. 8 and Fig. 10 show only a four harness "tie-up." This is done to avoid complications in the explanation. Any number may be used. This method of "tie-up" is especially desirable when an odd number of heddle sticks (harnesses) is used. It does away with pulleys and heddle horses.

The fact that each harness must pull either up or down makes a most perfect shed, thus avoiding the skipping of threads, so common in weaving when the shed is not perfect.

A FACT BASIS FOR DEVISING COURSES OF STUDY

Paul H. Graven, Director of Manual Arts, Madison, Wisconsin, and Thomas R. Faulkes, M. A., University of Wisconsin

CONCURRENT with the development of standardized measurement scales for the various subjects in the public-school curriculum has come a scientific investigation and study of what *should* be taught and what should be eliminated from the traditional course of study. Exhaustive study of the subject of spelling, for instance, revealed the fact that the pupil was expected to learn to spell from 10,000 to 25,000 words while ordinary individuals do not use a vocabulary of more than 2,500 words. As a result of this study by Ayres, James, and others, the most advanced schools are now teaching pupils to spell 1,000 words of common usage. Similarly a study of the subject of arithmetic has shown, on a scientific basis of facts, that much valuable time has been wasted on the study of compound interest, square and cube roots, and other purely technical items which are never used by the average individual. It is quite natural that similar studies should have been made in history, Latin, and other studies in the traditional curriculum. The aim in all these investigations has been to determine, upon a scientific basis, *what* should be taught the pupil to fit him to adjust himself to the world in which he lives.

Practically nothing of this kind, however, has been attempted in the field of manual and industrial arts. Three reasons may be ascribed to this. In the first place manual and industrial arts were recently incorporated into the school curriculum to fill a very evident want, to supply the *something,* neglected in the purely scholastic regime, which every normal child craves and the need for which has been revealed by inquiries into the reasons for the failure of a purely academic curriculum. Secondly, manual and industrial arts having been introduced to supply the missing element in education have been exempted from the necessity for investigation, altho they have frequently been subjected to destructive criticisms based merely upon the opinion of the critics. Thirdly, there is no question as to the fact that certain technical-school industrial departments have given their graduates the impression that their courses are standardized; and the graduates of these schools have gone forth to teach the things they have been taught.

Inquiry into the basis for courses of study in manual and industrial arts shows that they were formulated very largely according to the opinions of educators rather than upon facts. These subjects, however, having been introduced into the curriculum, to supply elements for which there was a crying need may welcome a scientific study of what should and what should not be taught with less danger of suffering seriously than may some of the traditional subjects.

The investigation of manual training pupils in the Madison, Wis., schools is indicative of the type of study which must be made to determine what should be taught and what should not be taught. Anyone applying such a test will discover that many things included in the present course of study may profitably be omitted and that new elements of greater value will be suggested by the results of the study.

The establishment of a *fact* basis for values of manual training is as yet a comparatively new field in the science of education. Such a study as the one described in the following pages suggests the wonderful possibilities of work in this field. This study suggests at the outset the need of work of this kind for the foundation upon which to build courses of study, and some definite suggestions will be made in connection with the data presented.

Unlike some studies that have been made in this field, the present study was not concerned with the matter of effectiveness in shop methods, teaching efficiency, or what are included under the term "motor abilities in shop processes." The attempt was, rather, to determine some facts in regard to the connection existing between the work as carried on in the school, and the use made by the pupils of the knowledge and skill acquired by the pupil in his daily life.

The attempt was made to confine the data of these apparently elusive values to some scientific basis in order that the conclusions reached would be based upon *facts* rather than upon the opinion of the investigator.

With the above points in mind, the writer sought to devise a test for public school manual training pupils which would indicate whether the boys made things which were used, whether or not they had tools at home to work with, whether or not they sought to make use of their skill in repairing at home, and whether or not they made use of their acquired learning in the earning of money.

The corrected and improved test finally assumed this form:

MADISON PUBLIC SCHOOLS.
Manual Training Department.

.....

Name..... School..... Grade..... Age.....

Write your answers in the space after the question.

1. What things have you made which are in USE or were in use in your home, barn, garage, or yard?

2. What repairs have you made on furniture, doors, windows, etc., at home, office, store, or elsewhere?

3. What have you learned in manual training to help you in the work you do to earn money? State exactly what you do.

4. Have you the common tools at home which you use readily in your work or play? If so, name them.

5. When repairs are needed do you ATTEMPT to make them, or do you call a skilled workman? Give examples of what you have done.

The tests were given by the regular instructors of

manual training after being outlined and explained by the supervisor at a meeting with his teachers.

The test was applied to boys in the fifth, sixth, seventh and eighth grades. The training these pupils receive is limited to one period per week, one hour for fifth and sixth grades, 90 minutes for seventh and eighth grades, and it should be borne in mind that all are below high school age and the results of the test should not be compared to results from more advanced pupils.

Seven hundred and fifty-seven pupils in the four upper grades or fifteen schools were tested; total numbers of pupils in each grade were as follows: fifth, 190; sixth, 200; seventh, 189; eighth, 178.

Interpretation of Answers.

Question 1. Every pupil tested named one or more articles which were used. Thus the answers to this question represented one hundred per cent affirmative answers. The value of the answers to this question lies in a study of the projects *in relation to the individual and his grade in school. Application* of this data in devising a course of study will be considered in a later paragraph.

Question 2. A mere *"Yes"* was not considered an affirmative reply. If the yes was supported by *reliable* information that the pupil had put a glass in a window, reglued a chair, or performed one or more similar works his answer was considered an "affirmative" reply. A record was kept of the nature of the repairs.

Question 3. A mere "yes" or "lots of things" was not considered an affirmative reply. However if a boy said, "I lathed and earned one dollar a day; manual training helped me by teaching me the use of tools," or gave an answer which indicated the application of definite things learned in manual training, it was considered affirmative. Such replies as "Learned to be exact, neat, careful," were not counted affirmative answers.

Question 4. Unless the pupil supported his "yes" with "hammer, saw, chisel," or a similar or longer list of tools it was not counted affirmative.

In each of the questions two, three and four in which percentages of affirmative answers were computed it was thought best to count as negative all answers which were *doubtful,* or which were not supported by sufficient evidence. In the case of the first 161 pupils tested this information was supplemented by that obtained in a personal interview. The attempt was to make the results absolutely reliable by considering as affirmative only those things which could be maintained as accurate, reliable, first-hand evidence.

Question 5. In this question the percentage of affirmative answers was sought. The examples cited by the pupil were included to form a basis for judgment as to whether or not the pupil was making the attempt. It was thought that one result to be expected from the study of manual training is the inspiration to attack new and similar problems under other circumstances than the school shop. It was thought that if an accurate determination could be made of how many boys were attempting to do things at home and elsewhere than in the school, it would serve as a reliable evidence as to one value of manual arts teaching. Therefor if the pupil wrote, "Yes. I fixed a window, chair, and put a board in the sidewalk," or presented similar evidence it was considered an affirmative reply.

Results.

The answers to question one are summarized in the following table. Projects made and used by the pupils fell within well defined groups indicated in the left-hand vertical column. Numerals indicate number of projects.

Project	Grades—Five	Six	Seven	Eight
Furniture	10	17	283	509
Kitchen	242	301	439	356
Toys	209	218	222	323
Shop	51	79	59	47
Household	225	319	312	313
Office	0	0	10	82
Totals	736	934	1325	1630
	Grades—Five	Six	Seven	Eight
Total No. of pupils in each grade	190	200	189	178

Grand total number of pupils..... 757
Total number of projects used..... 4625

Attention is called to the steady increase in production, which is even greater when we consider that there is an accompanying *decrease* in the number of pupils from the fifth to the eighth grade, so that the eighth grade has less pupils than the lower grades. It must also be remembered that the articles made by the eighth grade are of a more difficult nature than those made by the lower grade pupils.

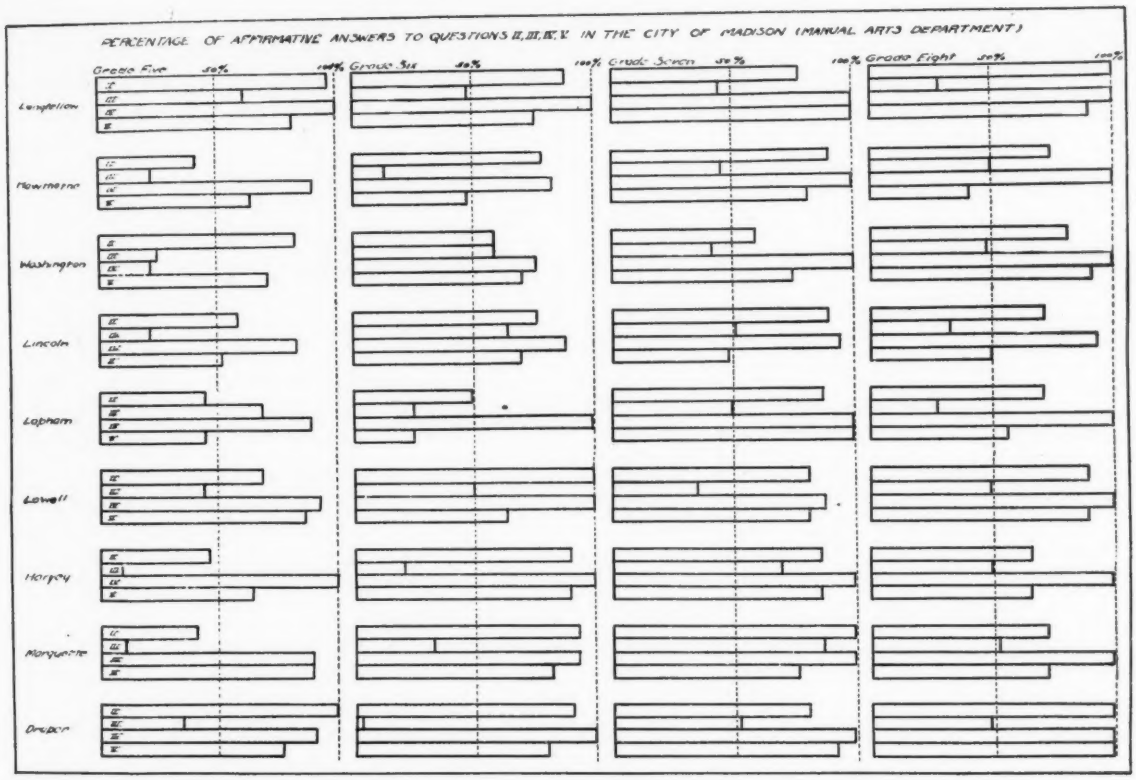
The play element is emphasized by the number of projects counted as "toys," which included everything suggestive of play. A detailed study of the data obtained reveals a progression in the difficulty and size of the projects included under this heading. That is to say, boys in the fifth and sixth were interested in the making (in school and at home) and the using of such toys as windmills, aeroplanes, wooden guns, swords, etc., while eighth grade boys found an outlet for the play instinct thru the making of such larger projects as bob sleds, autos, stilts, swings, dog houses, wagons, etc., ad infinitum.

Increased productivity with increased training is evidenced by such facts as that seven tool chests were made by eighth grade boys for use at home, while none were made by pupils in the other grades.

Fifth and sixth grade boys made use largely of articles for the *home* and *kitchen* included under the groups "household" and "kitchen." The latter group for boys in these grades includes such things as stirring stick, match scratcher, and corner shelf; while for the seventh grade boys it expanded to include such items as cutting board, wood and coal boxes, etc.

Conclusion.

While it is possible that the data obtained may reflect a well organized course of study with regard to progression, elements of play, etc., it is nevertheless true



GRAPH SHOWING PERCENTAGES OF AFFIRMATIVE ANSWERS TO QUESTIONNAIRE.

that the data obtained records only the projects which were of sufficient interest to pupils to stand the acid test of use in their everyday life; and it is also true that comparison of the objects used with those offered in the regular course of study will reveal the fact that not all the articles which the pupil was required to make were proving to be of vital interest to him or of use to him in his home life or play. A closer study shows that the pupils were making and using some things which were not included in the course of study. This data has been made use of in revising the course of study to meet the needs and interests of the pupils in the grades studied.

Projects named which were not included in the course of study may be grouped as follows:

(A) Windmill and other projects which suggest motion.

(B) Wooden guns and others which suggest scroll saw work.

(C) Child furniture, for playhouses, etc.

(D) Larger projects suggestive of community activity such as shack, chicken coop, coal bin, etc.

The percentage of affirmative answers to each of the last four questions of the test by each of the four grades in nine of the city schools is presented graphically in the accompanying photograph.

The final percentages of affirmative answers to questions 2, 3, 4 and 5 by pupils in grades 5, 6, 7 and 8 are shown in the table below. Percentages are figured on the total number of pupils in each grade.

Grades	Total number of pupils	Percentages of Affirmative Answers, Question 2	3	4	5
Fifth	190	64.8	29.5	87.5	66
Sixth	200	80.5	40	93	67.5
Seventh	189	79.4	41.7	82	67.3
Eighth	178	86	47.7	99	74

Question Two.

A glance at the graph shows that no class fell below 40 per cent of affirmative answers, and eight classes (with a total of 100 pupils inclusive) reached 100 per cent, while the other thirty-eight classes ranged at various points between 40 per cent and 100 per cent. Of the 757 pupils tested 587 or 77.5 per cent gave affirmative answers indicating that they made repairs at home.

We note in the accompanying table that the general tendency is for a larger number of pupils to make repairs as advancement is made from the fifth grade thru the eighth grade. Thus we see that while the sixth grade and seventh grade are both approximately 80 per cent, there is a wide difference between these grades and the fifth grade which has 64.8 per cent, and a corresponding difference between these grades and the eighth grade which has a percentage of 86. This result would mean that we should expect high school boys to show a higher percentage of affirmative answers than that made by the elementary boys. The result cited above indicates increasing usefulness in repair work at home proportional to the years of experience at school.

Question Three.

The graph shows that classes ranged from 3.33 per

cent to 89 per cent. Of the 757 boys tested, 300 or nearly 40 per cent gave evidence that they turn their knowledge of manual training into money. A study was made of *how* they do it in order that some things might be revealed which would help the other 60 per cent who did not seem able to "turn the trick." From the collection of evidence obtained of how the boys earn, material was selected for the purpose of presenting it to all the pupils as an *inspiration* to the boys to make use of their manual training in similar ways, and to stimulate them in using their own ingenuity in devising similar means of turning their learning into earning.

Question Four.

With the exception of one class all those reported have a record between 80 per cent and 100 per cent, or in terms of all pupils tested, 709 out of 757 or 93.5 per cent of the boys were credited with affirmative replies which means that they have the common tools at home which may be used in making the repairs listed in question two, and in performing tasks referred to in question three.

Conclusion.—This would indicate that a large per cent of boys have facilities at home for making practical application of their learning acquired in school. This argues for the possibilities of repairing or at least encouraging home work in manual training.

Question Five.

From 25 per cent to 100 per cent of the pupils *attempt* to make repairs instead of calling a workman. In three of the 36 classes shown in the graph *all* the pupils (100 per cent) make the *attempt*. In terms of all the boys tested, 545 of 757 boys or 70.5 per cent make the attempt to do needed repairs.

This large number of boys representing a large percentage of every class tested, from every section of a large city shows the universal need of such repairs. The fact that boys below the high school age attempt to make the needed repairs shows that they should be taught to boys in the grades. The initiative on the part of 70.5 per cent of the pupils in attempting to make repairs speaks well for the inspirational effect of manual training in attacking new and difficult problems, and of the development by manual training in the boy of the *sense of mastery* of material things.

The apparent contradiction in the percentages for the answers to question two indicating that 77.5 per cent of the boys gave evidence of repairs they had made, and the answers to question five showing that only 70.5 per cent of the boys would attempt to make all needed repairs is easily understood. Many boys made repairs on furniture and such small jobs who would not attempt larger work such as repairing the coal bin or the cellar steps.

Conclusion.

The study showed that the boys are receiving many things of immediate practical value in addition to educational and prevocational values which the work may possess. Many things included in the course of study are proving of use to the boys. It is also true that many things are included in the course of study which are of doubtful value. This is not a destructive criticism of the work or the course, but an indication of the method to follow in strengthening the course. Some things suggested by what the boys are attempting to do outside of school without instruction should be substituted for these things which have not stood the acid test of use in the life of the pupil. This has been done in revising the course of study.

The course of study for boys in the elementary grades should include an organized series of repairs of a household nature. The organization and application of such a course will be considered in a later article.

Fifth grade boys should have a chance to work on as large projects as possible as their muscles are not adapted to fine, accurate movements. These boys should have experience in handling larger boards, and more work in the use of hammer and nails.

The prominence and persistence of the play element in the life and interest of the boys argues strongly for the doctrines of interest and motive and their application thru providing a generous outlet for the play instinct in the choice of projects. They may be arranged with regard to progression so that the boy will improve as advancement is made thru the grades. The construction of a large ice-boat by a high school pupil this year is an example of the application of this principle.

Forty per cent of the boys are making application of their manual training in the work they do to earn money. Possibilities for the development of the earning habit are great when the work shall be taught with some indication to the boy of how he may turn his learning into earning.

Courses of study should be reorganized after such a study as the one described in this article. The chief emphasis in the organization of a course of study should be placed upon the consideration of the individual and his grade in school. This means that courses must be organized upon a "group" basis to allow for variation in interests, needs, and abilities of pupils. Boys in manual training classes must be considered as individuals and not merely as members of a class. Effective work will be done when the instructor realizes that he is using his subject as a means of teaching *boys*. Much time and money has been wasted under formal courses of study requiring every member of a class to make the same projects. This study reveals the need of organizing flexible courses of study to fit the needs and interests of the individual pupil, with special regard to his age and grade in school. Such a course of study will prove of real vital interest and worth in the life of the pupil.

"Great works of art are useful works, greatly done." —*T. J. Cobden-Sanderson.*

FORGING IN THE HIBBING PUBLIC SCHOOLS

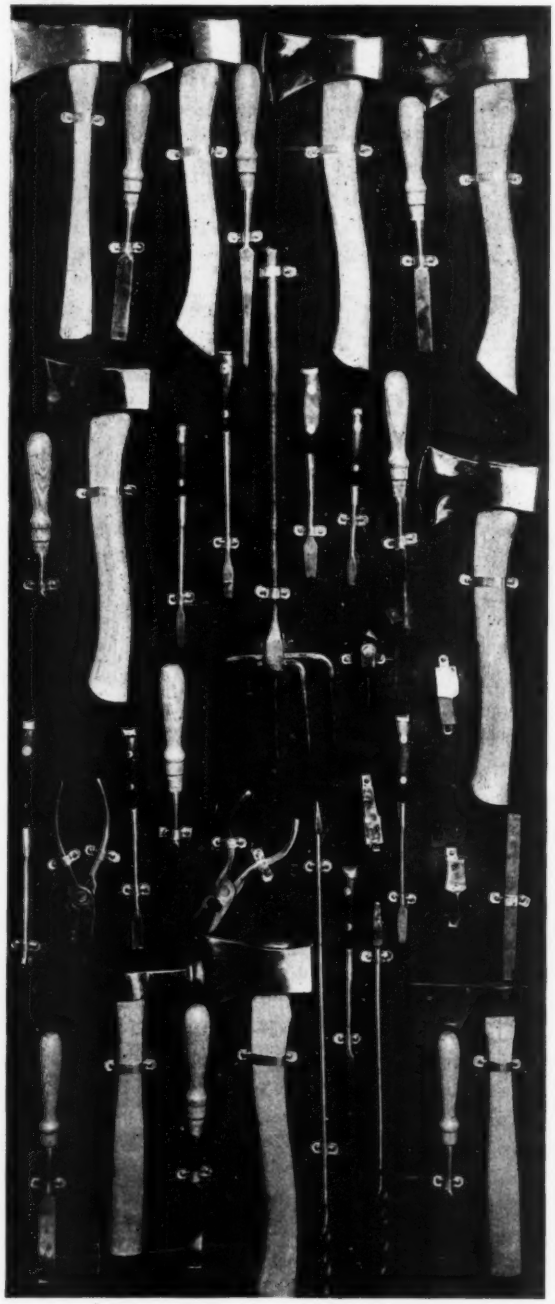
Jay F. Knolton, Instructor, Hibbing, Minn.

THE closing of the war has once more opened the discussion of industrial education to the public, but this time the question concerns the extent of the work in our public schools rather than value. War has proved that without the mechanic it would be impossible to turn our natural resources into implements for our defense and protection. It has also shown us that the peace war of world trade will be won by that nation having the organization and possessing the skilled mechanics necessary to produce at the greatest volume and lowest cost. From reports now available we have surprised ourselves, as well as the world, in our manufacturing ability. Such ability has been made possible by our organization of skilled labor. Industrial education will receive the credit due for its aid in making such a record possible, but we must expect the demand for a great many changes that will remedy some of its present faults and improve its efficiency. Such demands will no doubt change our courses, and tend toward specialization on the part of the instructor. The nation rather than the individual will receive the first consideration.

Forging is one of the subjects of which such demands are going to be made; and we, who have had training in this line should have our ears to the ground and be ready to respond to such demands as well as to guide them in bringing this subject to its proper place. For, if we are to make the United States of America the manufacturing nation of all nations, we can not fulfill this ambition until every factor of our nation lends its hand to such an end, the schools included. We have just entered the manufacturing and steel age and the school must do its share thru its forge shop.

Forging has in the past, been somewhat disliked by the student, and as a result a great many schools have relegated their equipment in this line to the scrap pile to make room for more popular subjects. This has been due to several causes: the nature of the work, the lack of desire on the part of the boy to work, and the inability of the instructor to present the subject in an interesting way and produce results that would justify a boy being interested. All drawbacks to this work must be overcome by results which a boy can see without the knowledge of pedagogy. We cannot expect a boy to become enthusiastic over forging when we offer him a course of small iron problems and then close the door to any further knowledge in this line. It is necessary of course that such problems be completed but why stop here when the boy has just reached the place where a most interesting as well as practical course could be offered him in tool steel work? We have just started when we offer the elementary course and the boy has received a very narrow viewpoint, while an advanced course would lead him to see the work in a broader way such as, the relation of the manufacturer to the nation and to the individual.

If we are to correct this mistake by offering advanced work, it will necessitate the lengthening of the time devoted to this subject either by offering two years'



Typical Forge Products of the Hibbing High School.

work or by increasing the hours per week. In the past we have been expecting too much of the industrial subjects where they have only been allowed three hours a week, or less, for thirty-six weeks. If more time can be given, it will, in most cases, more than justify the efforts, even if it makes necessary the lengthening of the school year.

The work shown in the reproductions has been made under such a plan at Hibbing, Minnesota. Five years ago, under the old plan it was almost impossible to obtain the students necessary to run a shop equipped for twenty, on a half time schedule. This year the demand for the work would have made possible the running of two shops of like equipment. This bespeaks the interest created, while the grade of finished work can be judged from the reproductions.

The changes made were:

1st. The lengthening of the school year from nine to ten months.

2nd. The lengthening of the hours per week from four and one-half to five.

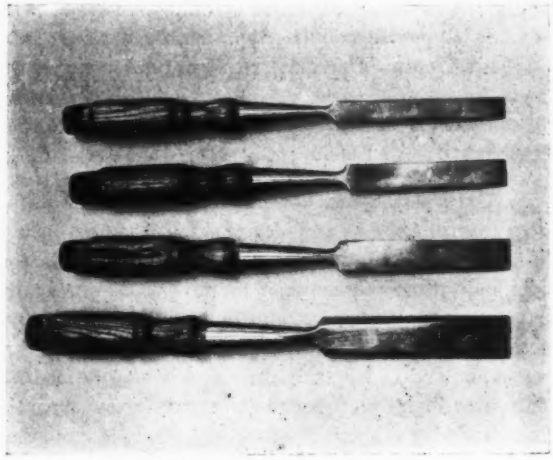
3rd. Shortening of the periods from ninety minutes three times a week, to sixty minutes five times a week.

4th. The offering of the iron work to the boys of the seventh grade.

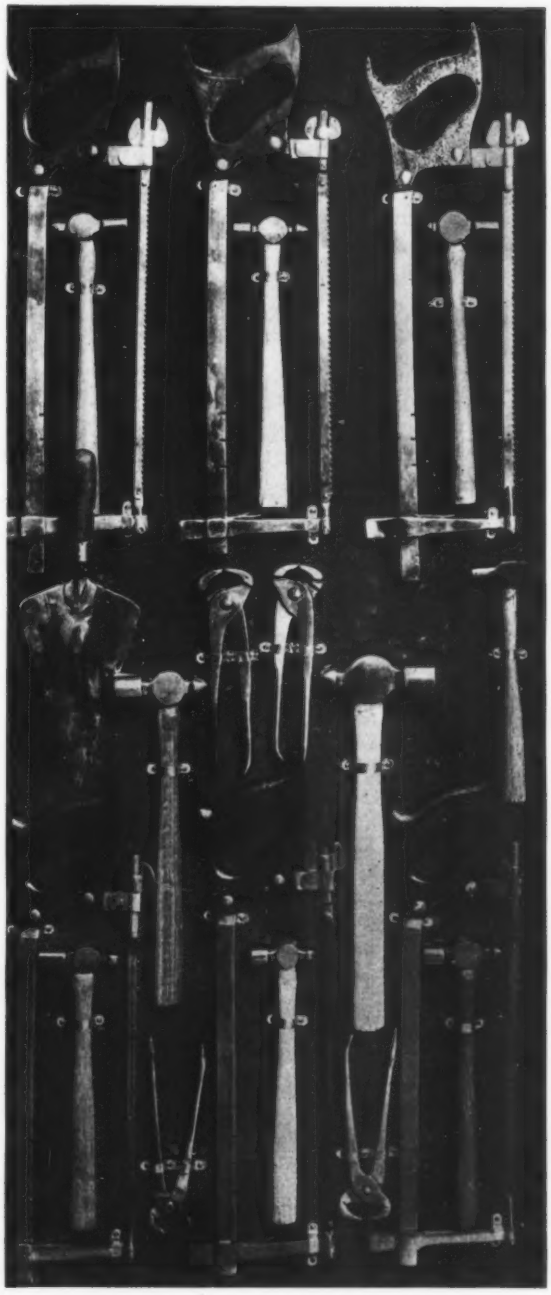
5th. Making the projects interesting without sacrificing the important tool processes.

6th. Offering a second-year course in this work. The offering of the iron work to the seventh grade boy seemed radical at first but these boys have proved themselves capable of obtaining the fundamentals of the art more readily than the boys of other grades. They are willing to work, get dirty, and the results in the form of small iron problems appeal to them more than to the older boys.

The seventh grade boy is unable to devote ninety minutes to the work at one time, and work as efficiently the last thirty minutes as he does the first thirty. This fact caused us to shorten the periods to sixty minutes



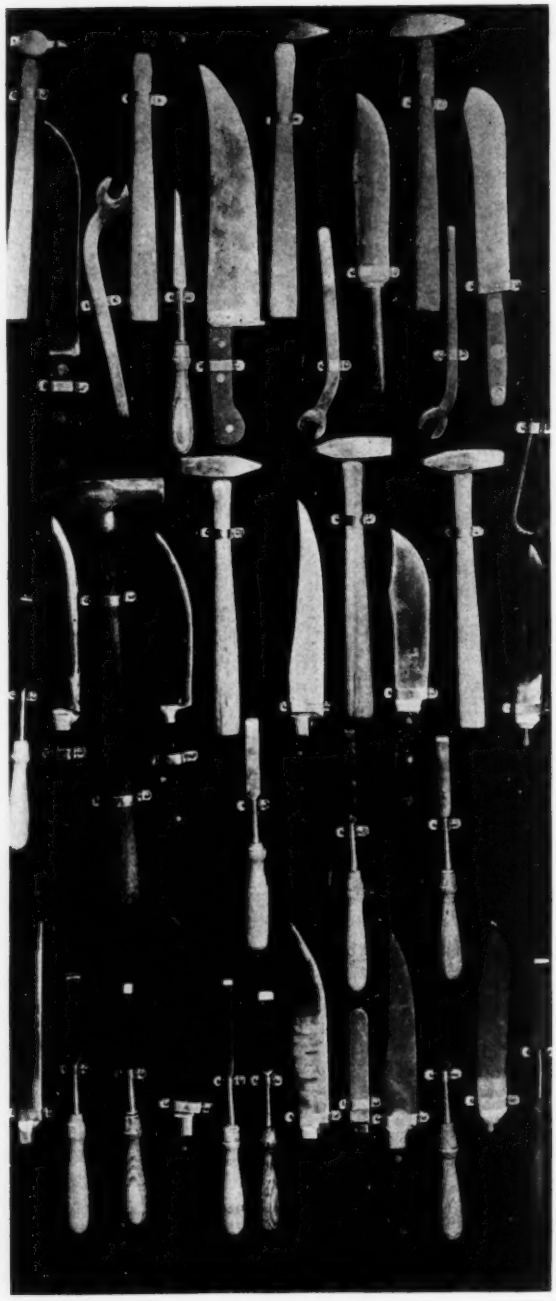
Chisels made by Hibbing Students.



Tools made in the Hibbing High School.

in all forging classes. It was also found necessary to reconstruct the course to fit the grade. With these two changes, the work has been carried on here for the past five years in the seventh grade with very good results.

At first glance the work shown would appear to be far beyond the ability of the eighth or even the high school boy, but such is not the case. The problems are not as difficult as they appear. Boys in the second year work progress far more rapidly in skill than in the first year, and they are at an age when it is possible to obtain results by instruction rather than by drill. Some seventh



Edge Tools, etc., made under the Author's direction.

grade classes have proved themselves capable of doing very good work in the advanced tool steel problems, but such, of course, are the exception.

Because of the location of this particular community, which is surrounded by innumerable lakes and forests, where fish and game are abundant, the boy's interest is keen for implements that he or his father can use on their hunting and fishing trips. Such conditions would show the instructor his opportunity by offering a course containing such problems as: hunting axes, hunting knives, traps, fur stretchers, camping stoves, frying pans, fish spears, fish bait, gaff hooks, and other problems of this nature. These are not the only problems that will interest boys even in Hibbing, for since the automobile has taken its place it has created in nearly every boy a desire to own good tools. This is a worthy desire and should be encouraged. It is not enough that such community interests be seen and problems selected but they must be worked out to fit the boy's ability. Every problem can be made simple or difficult and it is in this part of the work where most mistakes are made which result either, in overloading the boy to the point of discouragement, or in causing him to spend his time on a problem which, when completed, falls far below his expectation.

Concrete examples of problems that may be made more or less difficult to fit the needs of the different grades are shown in the photographs reproduced. The hunting knife is a good illustration. The small simple ones shown were made by the seventh grade, the more difficult by the eighth while the fancy hunting knives were made by high school boys taking their second year work or some taking extra work in the third year. The hammer works out the same way. The small cross pene hammers were made by the seventh grade, the ball pene by the eighth—its size determined by the boy's strength—while the large ball pene and claw hammers were made by high school boys.

The equipment used in this work is as follows:

1. Forges and regular tools to handle a class of twenty boys.
2. One small power drill.
3. One buffer.
4. One emery grinder.
5. One hand power punch and shear.

As this is very little more equipment than the average shop already has, it speaks well for the offering of a second year course from the standpoint of cost. Such a course will also tend to keep the forging equipment in use every hour of the school day, a fact which points toward efficiency.

Such an advanced course will aid the nation, make the boy happier as well as give him a broader knowledge of the coming working material, keep the forging equipment in use more hours per day, all without extra cost of equipment. We improve the regular subjects to their highest state of efficiency; why not the industrial work?

As a rule the only person connected with a work of architecture who has any idea of what is wanted in it is the architect himself; and at every turn he has to correct and oppose the habits of the mason, the joiner, the cabinet-maker, the carver, etc., and to try to get them to imitate painfully the habits of the fourteenth-century workmen, and to lay aside their own habits, formed not only from their own personal daily practice, but from the inherited turn of mind and practice of body of more than two centuries at least.—*Wm. Morris.*

Teaching Mechanical Drawing to Apprentices

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IN order to be successful, the modern mechanic must not only know how to use the tools required by his trade efficiently, but he must be equally expert at interpreting the thoughts of others as expressed on drawings, sketches and blue prints. Drawings may rightly be looked upon as being the written orders of the shopman, and the mechanic's skill becomes readily available only in proportion to his ability to read these orders correctly. As the shop product becomes more and more complex with the increased demands of modern times, the mechanic (be he machinist, toolmaker, patternmaker, or what-not) must be more and more expert in deciphering the drawings which picture the work. A thoro knowledge of this valuable art of reading drawings is therefore of utmost importance in the development of the apprentice, and the necessity of it becomes evident to any layman who looks at a finished mechanism, and then at the maze of lines and dimensions from which the mechanic has constructed it.

How then, should the apprentice be taught the art of interpreting, or as it is commonly called, reading a drawing? Can the ends be attained by furnishing the student with a large number of shop drawings, and explaining them thoroly, or should the student be taught to make more or less complicated drawings himself in order to thus acquire the facility of reading those made by others? A discussion of how we teach the art to the apprentices in Milwaukee may furnish interesting and, we hope, helpful suggestions to other instructors.

The first question of course is what should be taught, and then, how should the subject be taught. At the outset we must decide whether the blue print reading method should be adopted, or whether actual drawings should be made. The present day method of teaching any subject tends toward assisting the student in not only memorizing a method, but by having the student perform the different processes required, assisting him in understanding the underlying principles, and thereby fix them in his memory. We therefore emphasize the making of drawings in our course, and give the blue print reading, as such, a secondary place. The student learns by actual doing, just how an idea is put on the paper by means of a drawing. He thus becomes acquainted with the main principles used for representing an object, and his knowledge may be tested from time to time, by actual blue print reading, which is described later in this article.

Another decision which must be made, is how to outline a course, or courses, which will satisfy the wants of apprentices in the trades of machinst, toolmaker, patternmaker, blacksmith, boilermaker, and draftsman. That the work for the different trades requires differentiation is apparent at once. The elementary work can be outlined in such a manner, however, that it will cover the principles involved in mechanical drawing, and thus give the apprentices of all trades a grasp of the subject, but these elements must then be amplified by problems directly related to the trade of the individual student. The makeup of our classes makes it necessary that the work be largely individual. This necessitates that the instruction plates, which are put in the hands of the student, be practically self-explanatory. Besides some kind of representation of the object which the student is to draw, these instruction sheets must give a short description of its uses, the material of which it is made, directions how the views are to be arranged on the drawing, what scale to use, etc.

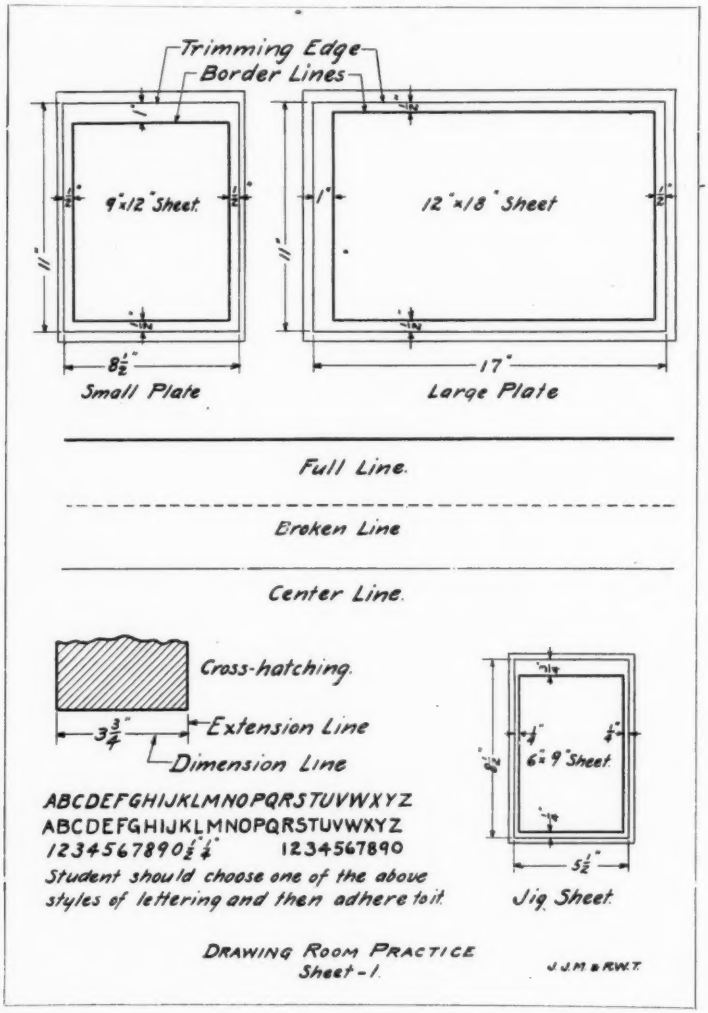
A perusal of many books on the subject of mechanical drawing and shop sketching shows a marked difference between those of the older school, and those which follow the modern method of teaching. The older textbooks are replete with lessons in which straight lines, curved lines, and circles, are combined to form geometrical designs as weird as they are difficult to draw. Then there are numerous geometrical problems which are followed by tedious plates on vertical, slant, and block lettering, after which comes a formidable array of square, hexagonal, and cylindrical prisms, with a generous number of pyramids arranged at many and diverse angles. After having finished all of this preliminary work, the student is then deemed fit to attempt his first shop drawing. The modern method is to discard all of the introductory work, and the student starts at once to make a shop drawing of a simple object with which he is familiar.

The first plate of a drawing course should be very simple. It should consist of vertical and horizontal lines only, and there should be but few dimensions and little lettering. The drawing should be so simple that the average student can readily finish it in two or three hours. Since it is assumed that the student has had no previous instruction in mechanical drawing, it is well to make the first instruction plate in such a manner that the student can make a direct copy of the drawing. This means that he can concentrate his mind on the manner of drawing the lines and handling the T-square and the triangles, which are entirely new to him, rather than deciding upon how to arrange the views. It is also well to have an isometric or perspective sketch of the object to be drawn on the instruction plate. A model made of metal or wood will further assist the student in visualizing the appearance of the views and the arrangement thereof on the drawing. By giving all of these aids to the student for the first drawing, the different steps become much clearer to him, and mechan-

ical drawing becomes interesting at once because the meaning of each view, and the reason for making it, can readily be grasped.

The character and style of the different kinds of lines, which are used in mechanical drawing, should be explained and illustrated as they are to be applied. Only such lines as are commonly used in large drawing offices should be taught, and the obsolete styles should be carefully avoided. Thus, object lines should be made quite heavy. One objection against the use of heavy lines is that measurements can not be taken from the drawings. This objection however, is not very weighty, since most shops have stringent rules which forbid the workmen to make direct measurements on a blue print or drawing. A drawing made with firm heavy lines insures a good blue print which can easily be read. Of course for some work, a light line must be used. Thus, on layouts for the patternmaker or machinist which are to be used for templets, or on sheet metal or boiler plate developments, nothing but light lines are permissible. Center lines should consist of long light lines separated by short dots or dashes. Dimension lines should be light full lines, and the broken lines should consist of a series of short dashes made somewhat heavier than center lines, but not as heavy as object lines. The cross hatching used to indicate sections should be about as heavy as center and dimension lines. A good plan is to make a chart which can be posted in the drafting room which illustrates the different kinds of lines which are to be used by the student. Sheet I of drawing room practice shows the arrangement of the chart.

After the student has become acquainted with the use of the T-square and triangles, he should be taught how to plan the arrangement of the required views on a drawing. In order to prevent him from merely copying, the drawing on the instruction sheet should be made to a different scale than that which the student is to use. It is well also to require a different arrangement of the views than those shown in the instructions in order to test the student's grasp of the subject.



The next step is to learn how to make drawings to scale. Ordinarily, drawings which are used in the

machine and pattern shop, are made to the following scales: full size, half size, three inches to the foot, one and one-half inches to the foot, and one inch to the foot. The student should be shown how to use the triangular scales commonly used by draftsmen when making drawings to scale.

It is rather difficult to decide just how much technique to require in drawings made by apprentices. Before definitely ruling on this point, it is well to remember just what is aimed at in teaching the subject. The apprentice draftsman is expected to learn not only how to make drawings correctly, but neatly and rapidly as well. He should be able to letter well and he must be a good tracer, because that is what he will have to do in the drafting room for the first few years of his apprenticeship. Apprentices in the other trades, however, are not required to make drawings in the shop, hence the technique required from the drafting apprentice should be of a higher grade than that of the other students. A good safe rule in deciding whether or not to pass a given drawing is to see whether it would pass muster in the shop. Slovenliness should of course be carefully guarded against, but no valuable time should be wasted by insisting on an impractical degree of perfection.

Lettering too can be overemphasized. It is true, poor lettering will spoil a good drawing, but if the aim of the drawing course is to assist the apprentice in learning how to read blue prints, then the lettering, as such, deserves only secondary consideration. For this reason there are no special plates in our course, devoted to lettering only, for apprentices who are not indentured as draftsmen. For the latter, good lettering is a requirement for success, and they therefore receive special drill in this branch of the study. The lettering should in all cases consist of plain capitals, either vertical or inclined, and all flourishes on the lettering should be strictly avoided. Many large firms insist on vertical lettering on their drawings, but practice varies somewhat on this point. The majority of our pupils have learned the slant system of penmanship, and they therefore find it somewhat easier to do slant lettering. We have found it advisable to let the student take his choice of either the slant or the vertical lettering, and then insist on plain, legible, lettering.

Another point in which the apprentice receives instruction, is the use of tables and empirical formulas in connection with the drawings which he makes. He thus becomes acquainted with information which he must use, later on, in the shop. Some of the tables with which he thus comes in contact are the following: Standard bolts and nuts, sizes of tapping drills, decimal equivalents, proportions of wrenches, crane hooks, machine and set screws, pulleys, gears, gear tooth dimensions, shaft key sizes, Whitney key dimensions, drills for tapered pins, and many more. The use of these tables and formulas often entail computations, hence they establish a valuable correlation between the drawing and shop arithmetic courses.

After the apprentice has had considerable practice in laying out and making pencil drawings, he is instructed in the art of inking in drawings and making tracings. At first we had these tracings made on cloth, but since war conditions have practically doubled the price of this commodity, we have been able to achieve quite a large saving by using tracing paper. Many good grades of fairly cheap tracing papers can be found on the market, but only such as are tough enough for at least one erasure can be used in this work. The student should receive definite instruction in stretching the tracing paper, chalking it, manipulating the ruling pen, etc., before he starts his first tracing.

After the pupil has made several tracings he should be allowed to make a blue print from one of them. For this purpose a blue print frame which will accommodate a 12″ by 18″ sheet will be found sufficiently large. An accompanying illustration shows a very simple frame which has been in use in our school for the last six years, and which will be found to be an easy problem for the pupils in the wood working shop. It is not advisable for the teacher to try to prepare the blue print paper because the purchased article will be found to be cheaper in the end, and the results obtained with it will be much more uniform than those with the home-made product. It is also well to avoid laying in too large a supply of the blue print paper, because it deteriorates even if kept in a dark place.

Another valuable exercise for the drafting room is the making of data sheets, or jig sheets as we call them, which contain ready information for use in the shop. Pupils in our classes have prepared jig sheets on the following subjects: Decimal equivalents, chord factors, bolt and screw tables, tap drill and pipe tap tables, allowances for drive, force, and running fits, proportions for diametral and circular-pitch gear teeth, and others. Blue prints of these jig sheets are always kept on hand, and the pupils are provided with them gratis, for shop use. The popularity of these prints is evident, for many mechanics ask the apprentices to procure copies of certain ones for them.

After the pupil has finished the prescribed drawing course, for which we have prepared about thirty plates, he is put on shop sketching. The lesson sheets of this sketching course give an outline drawing of the object to be sketched, together with directions as to the views which are to be drawn. The pupil selects the proper model from a large number of castings which we have gathered, and which are stored on a series of shelves in the drawing room, when not in use. A freehand sketch is made of the object and the required dimensions taken with steel scale and calipers. A regular shop drawing is then made from the data thus obtained. This sketching practice is of great value to the prospective journeyman, who may at any time be sent out on a journey

which may mean hundreds of miles to gather the required information for making repair parts which must accurately fit into their respective places.

In order to give the pupil a model of how to dimension drawings correctly, Sheet 2 of drafting room practice has been prepared. This sheet also shows the proper manner of drawing corners, fillets, and roundings, besides giving examples of how to use the broken line under varying conditions. The conventional methods of showing sections made of different materials are also illustrated on this chart so that the student may refer to them when necessary.

Since the apprentice takes mechanical drawing mainly to acquire skill in the reading of blue prints, it is well to test his knowledge from time to time, by requiring him to give a description, either written or oral, of a more or less complicated piece of mechanism shown on a given drawing. The main dimensions of the different pieces, the sizes of bolts, screws, and other standard parts, the materials used, etc., should be discussed in his answer. To test his powers of observation, and to put him on the alert for like occurrences in the shop, it is well on some of these drawings to indicate a part incorrectly, or omit it in one or more of the views. The dangers of first angle projections can also be called to his attention in the same manner. Another valuable blue print reading exercise is to require the student to correct all affected dimensions in the different views on a drawing, after changing one or more dimensions on one of the views.

For the instructor who is looking for a text, the following books are recommended:

Mechanical Drawing Problems, Berg and Kronquist, The Manual Arts Press, Peoria, Ill.

Engineering Shop Drawing, Extension Div., University of Wisconsin.

Mechanical Drawing for Secondary Schools, Crawshaw & Phillips, Scott, Foresman & Co., Chicago.

Mechanical Drawing for Trade Schools. Leeds, D. Van Nostrand Co., New York.

Mechanical Drawing, Mathewson, Taylor-Holden Co., Springfield, Mass.

For Reference.

Mechanical Drawing and Machine Design, Reid & Reid, John Wiley & Sons, New York.

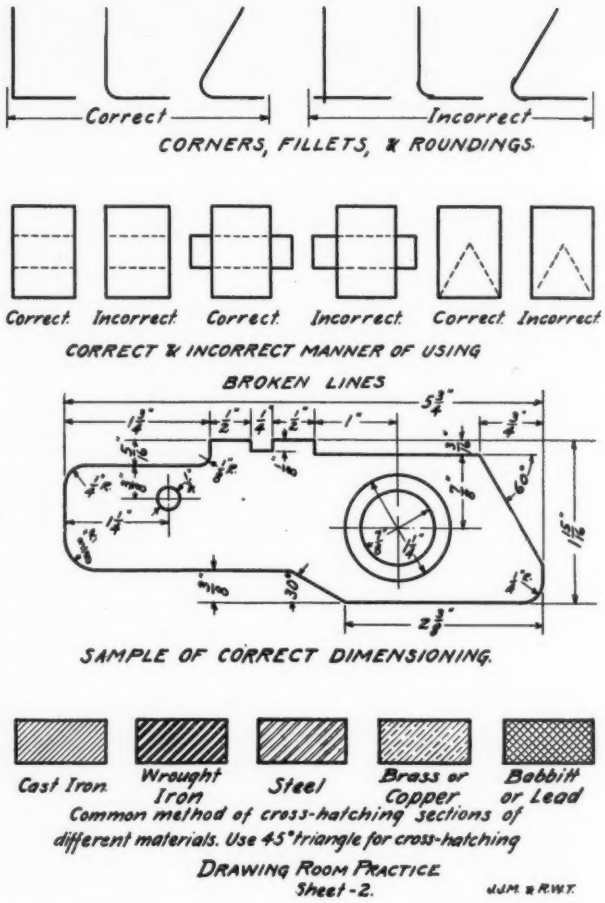
Engineering Drawing, French, McGraw Hill Book Co., New York.

A mechanical drawing course may be built up on an outline as follows:

Plate 1. Simple object with horizontal and vertical lines only, thus giving practice in the use of the T-square and triangle. The use of the extension and dimension lines is also introduced.

Plate 2. Simple object which requires the use of horizontal, vertical, and slant lines.

Plate 3. Simple object which requires the circle in at least one of the views. The use of the center line and



the broken (commonly called dotted) line should also be introduced, and their uses fully explained.

Plate 4. Object which requires straight lines to be drawn tangent to circles.

Plate 5. Object which requires the drawing of tangent arcs.

Plate 6. An object for which dimensions can be figured from a formula when the size or number of the given object is known.

Plate 7. A study of conventional methods for showing screw threads. Methods of drawing hexagon and square bolt heads and nuts.

Plate 8. The use of sections. For commonly used conventional methods of cross-hatching see sheet 2 of drawing room practice.

Plate 9. Pulley or fly-wheel. Show conventional method of showing the section thru the rim and hub without cutting the arms.

Plate 10. Detail of a square threaded vise screw.

Plate 11. Detail of the body and sliding jaw of a bench vise.

Plate 12. Detail of swivel jaw and steel faces for bench vise.

Plate 13. Assembly of the above bench vise.

Plate 14. Assembly drawing of a given object for which all details are given.

Plate 15. Make a drawing and tracing of a square cast iron foundation washer.

Plate 16. Make drawing and tracing of an object which involves the use of straight lines tangent to arcs.

Plate 17. Make drawing and tracing of an object which involves the use of arcs tangent to each other.

Plate 18. Make a tracing of a given pencil drawing. Drawing should be fairly complicated.

Plate 19. Make an assembly drawing of an object, like a shaft coupling or the like, for which the dimensions must be calculated according to an empirical formula.

Plates 20, 21 22 and 23. Make fully dimensioned details from a given assembly drawing.

Plates 24 and 25. Make tracings of plates 22 and 23.

Plate 26. Make a shop drawing of a gear for which the number and pitch of teeth, width of face, size of bore, and length of hub are given. Dimensions for thickness of rim, size of arms, diameter of hub, etc., to be calculated from given formulas.

Plate 27. Make a shop drawing of a bevel gear for which the number and pitch of teeth, width of face, face angle, pitch angle, cutting angle, size of bore and hub are given.

Plate 28. Make a drawing of a worm and worm wheel.

Plate 29. Require a drawing of some object used or manufactured in the shop where student works.

Plate 30. Make a drawing of a gas engine piston, giving all main dimensions with proper + and — limits.

Plates 31, 32, 33, 34. Make detail drawings of a single cylinder gas engine.

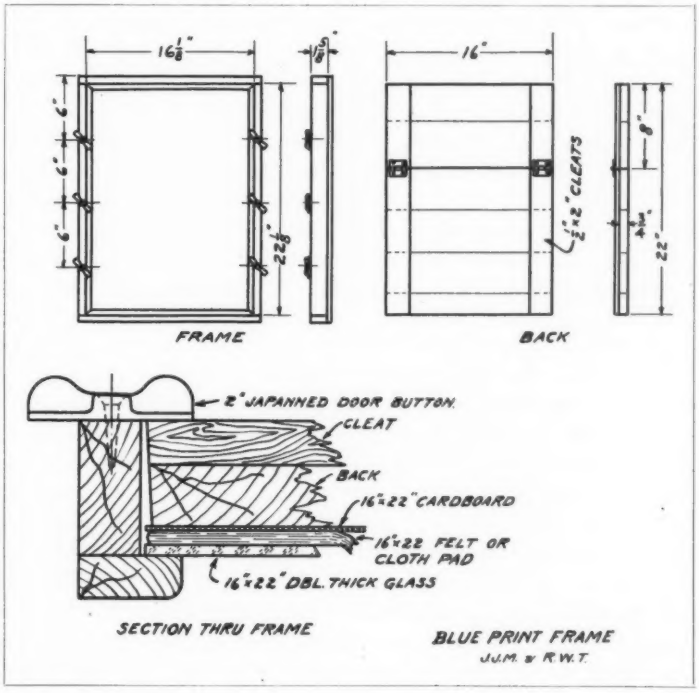
Plate 35. Make an assembly drawing of the above.

After finishing the above drawings, the student begins the sketching course already mentioned.

In order to assist the instructor in discovering whether the pupil has acquired the information which was to be imparted by a given lesson, a few questions should be based on each lesson which will emphasize the salient points. A scheme similar to the one described in our February, 1919, article, may be worked out for the grading of drawings. A time limit has been set on each drawing lesson for the rapid, average, and slow pupil, and neatness is taken into account as shown by the following table.

	Rapid	Average	Slow
Very neat	97%	87%	77%
Neat	95%	85%	75%
Fairly neat	93%	83%	73%
Passably neat	90%	80%	70%

If a drawing is finished 10% to 25% ahead of time, add 3% to the above ratings.



If 10% to 25% more time than the allotment is required to finish a given drawing, deduct 3%.

For each criticism on the drawing, such as uneven line, double line, poor letter, incorrect method of crosshatching a section, poor connection of tangent lines, improper thickness of lines, poorly spaced dimensions, etc., ½% is deducted. The minimum passing grade has been set at 70%, and if a pupil receives less than that on a drawing, he is required to redraw that particular plate.

The value of a thoro course in mechanical drawing for the apprentice, is really greater than a first glance discloses. Not only does the apprentice gain facility in reading the blue prints from which he has to work in the shop, but he also equips himself with the rudiments of another trade, which he can, with a little extra study and practice, make his own. Many of the best tool designers are men who served their time in the shop. Their experience in making special jigs and tools admirably fits them for the designing of tools. Some of our apprentices have already availed themselves of the opportunity of becoming draftsmen, and have entered the drafting room shortly after having finished their apprenticeship in the shop. The four years which they served at their trade should not be looked upon as time wasted, for the knowledge thus gained will materially enhance their value in the drafting room. This particular phase of the value of a mechanical drawing course should not be overlooked by the instructor, for with it in mind, he has one more argument at his command with which to convince a sceptical student, and make the work in the drawing room more acceptable and interesting because of its utilitarian value.

RELATION OF COSTUME DESIGN TO FINE ARTS

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CLOTHING, in the largest sense being a national problem deserves, because of its social and economic relation, serious and orderly thinking on the part of every woman. Costume design in its art aspects affords a practical field for the application of all the principles of design and color. "Good design in costumes, as in all design, has fine relation of spaces" and for an artistic result there must be a plan, an idea carried out in the entire costume to give an orderly arrangement of lines. If this fine relation of line, of dark and light, of color does not exist, then the result will be commonplace.

Costume design should in reality be considered as a craft just as jewelry is one, and should be studied in its relation to art as all other crafts are. In fact, Costume design probably offers one of the most live fields for the application of art principles. That is, the study of costume design cannot be presented without being very definitely and closely related to some form of art work, whether it be drawing or the study of the fine arts, as painting, sculpture, and architecture. Such study will aid in the appreciation of beauty and in turn help in its application to costume.

In order to show more specifically the relation or correlation existing, a discussion of perhaps socalled typical courses will serve best to illustrate. The two most general methods of presentation are the intensive or more advanced type and the general course (usually given in high schools) where costume design is presented as part of the regular sewing course. It is this latter course which I shall outline first. The work has three distinct phases: The study of textiles, of costume design, and the practical work, for which three periods usually are devoted to textiles or costume design as against four for sewing. Such a course aims to give to high school students a glimpse, as it were, of the economic and social values of the work as well as the technical sewing, and also to show them how very closely art principles are wound up with every bit of their actual construction work, be it an apron, or a dress that is made. The instruction should be not merely for the purpose of giving to theory a practical expression by means of work done, but it should aim as well to give the girls ability to recognize what is good and to bring before them, thru the development of subject matter, the dual aspect of the work in its relation to the immediate problems of the home and to art.

Supposing the class to have made an elementary project, say a traveling case, along with which design of material, placing of pockets, etc., has been discussed, they will next be ready for a waist problem. Fashion magazines are consulted and the girl chooses a waist suitable to the material (which has been first the basis of a selection lesson) and to herself. This is approved by the instructor and while the technical work proceeds, other periods are given to the discussion of art principles here involved. For example, a normal lay figure is given to each student which serves as a basis for an outline drawing. This is traced by the student and clothed, as it were, by her. The waist being the first problem, she is given elementary instruction in representation first, i. e., she is given instruction in how to represent tucks, plaits, ruffles, buttons, stitches, seam lines, etc., and she sketches the waist which she is actually constructing. A study of the effect of lines, horizontal accenting breadth, vertical emphasizing height, follows and again with the lay figure as the starting point, the student sketches (with the aid of fashion books) waists, the design of which tends to lengthen or shorten the waist, or sleeve or to broaden the figure or make it look more slender, etc.; in short, to develop, by arrangement of spaces and lines, such designs as will emphasize the good points of the figure or on the other hand conceal the poor points. An impersonal study of the two abnormal types of figure are made, the stout and very slender. It is shown why a short person needs to use every line that will emphasize her height and thus apparently decrease her breadth, and that the reverse is true for the very slender figure. An analysis of the latter type shows

that she must avoid vertical directions in main or structural lines and in striped materials in her dress. "Narrow, clinging clothes trimmed vertically will but exaggerate her height and slenderness. She must learn to avoid deep yokes which will divide the waist into two equal parts, lines which meet in angles over the bust and make her appear hollow chested, and tight sleeves which emphasize sharp elbows. In every way she must avoid severe angular lines in costumes." In general I agree with this statement yet not infrequently an emphasis of those characteristics adds to the consistency of the whole personality. There are cases I believe where extreme height and thinness have been changed from awkwardness to distinction by such added emphasis.

The waist being made usually of a plain material, the selection is based more on the kind of material and color and involves no necessary study as yet of effects of stripes, plaids, etc. However the arrangement of tucks, plaits, buttons, etc., is another practical application of spacing and effect of lines, contrasts in the width of tucks, relation between widths of tucks and the intervening spaces, can make the design of the finished garment either distinctive or ordinary. An opportunity is given the girl to exercise her sense of appreciation of well spaced, finely proportioned tucks. "Equal widths in tucks or in tucks and spaces produce monotony. Making all tucks different in size will also be uninteresting. There needs to be a degree of symmetry and repetition in the width of spaces and tucks to produce a harmony of the whole." Here is a dual chance again for girls to execute these on paper as well as make direct application to the practical problems in hand. The next problem is a dress and here a broader discussion is made possible by use of other than plain material, stripes, plaid and figured materials being discussed. The simplest form of design in its relation to dress is grouping of such parallel lines as are found in striped materials to produce good spacing, and here, a designer (tho restricted to straight lines only), has recourse to a wide range of expression in spacing, texture and in color. Of course she first has to consider purpose of material, but here, I am only discussing material suitable to lingerie dresses and as such, the effect of such stripes on the figure.

With plaids, the student comes to see that harmony in design depends on the use of lines and masses of light and dark and color. The three main elements involved in the design of a plaid are the principles of dominant and subordinate lines, repetition and opposition. While the student probably does not actually work out plaids, she does thru seeing both good and bad examples of plaids, acquire a basis of judgment for distinguishing between them. Color also emphasizes good proportions and spacing, and as easily points out defects. Good and bad design in figured materials is discussed too, involving the same general principles. With the material decided on, the student selects and sketches, making any adaptation necessary for her own figure, and then as in the case of the waist, she also sketches other dresses with dominating horizontal or vertical lines, etc. "Now the entire figure is studied as a silhouette and as such it must represent a balanced silhouette, the lines must flow rhythmically into one another for the figure is created for movements and must present balance in action." The costume is studied so that it is in harmony with bodily proportion as well as prevailing design, and the design within the silhouette must also be in accord. Some may question the use of the lay figure here, but in a general course of this type, I believe this method for outline sketching is better than pure drawing where perhaps more individual study of the figure might be possible.

The outline of the drawing of self becomes the boundary of a surface that is to be broken into pleasing space relations thus forming the design and the harmony of the design will once more depend on the relation of the parts to the whole. Within this outline the student learns to represent the main structural lines: Where to place the line representing the center of the figure as it curves over the chest; how to balance the foreshortened side of the figure; how to divide the waist line, the arm's eye, etc.; how to represent, modify and elaborate a design. Even tho it be only a collar and its corresponding likeness in cuffs that is changed, the whole effect of the waist may be altered. This offers ample opportunity for creative imagination and inventive power and this drawing is not given with the idea of acquiring any finished technique in sketching but gives to the student the idea of how to work things over, affords a basis for intellectual activity and concentrates her attention.

Some modeling with paper is done and here again is an opportunity for practical application. With paper representing the material, they are supposed to design a waist or dress which should be wearable if not so fragile. They see very clearly the effect of line and come to realize and feel the actual position of constructive lines on the body. They can see the effect of a shoulder line if brought too far forward or backward, etc., as they could not see it perhaps in just sketching, tho to a certain extent, this same thing may come with their technical work. While no attempt is made to represent detail of material as laces, fur, etc., on paper, buttons when comparatively flat are cut as circles from paper but material must be represented as thick when buttons do affect the silhouette.

Only such time as a course of this kind allows is devoted to the study of color in relation to costume design. The colors of the spectrum are put on the board perhaps and color harmonies are explained. Opposite, adjacent and monochromatic colors here are discussed and explained simply and briefly. Also the method of graying colors. Illustrative material, such as pictures, is on hand from which the girls pick out color harmonies and they are asked then to bring in samples of material which will illustrate the above harmonies, and possibly

they discuss how they could work out one of these harmonies in one of the dresses they have sketched.

This about comprises the content of such a course which touches only the high spots, as it were. However, if such courses which aim to give girls proper directions, could be instituted early, I believe a sentiment for the fundamental facts governing appropriate dress and for intelligent and discriminating choice, could be instilled into the minds of the girls. If they are brought to see that simplicity in dress is the foundation of beauty and refinement then I would say each girl would be able to create a standard for herself, as her choice would then be based upon her obedience to art principles. In making this statement I should like to define simplicity as not being synonymous with plainness or lack of elaboration in which way unfortunately, the average student comes to think of it. For example a cathedral facáde has simplicity yet is enormously complex.

In viewing the historic development of costume we find the style of costume determined by the needs of the people, by climatic conditions, by material, and by occupations; secondly, by the dominant idea in society, whether it be athletic, religious, aesthetic or national; thirdly, by ideals of beauty, whereas the material of costume is determined by industrial conditions largely. Considering the importance of dress the study of historic costume is valuable in that in it we see the source of our modern dress and as such, one ought to be able to recognize the styles of periods from which they were derived and thus to apply such knowledge in improving modern styles of dress. This necessarily involves much study of pictures, paintings, sculptures, illuminations and with such a wealth of art material, one cannot help but see great possibilities for correlation in such a course. Where the historical course is given other than purely as a history-of-art course it should be broader in scope giving the student an opportunity not only to see but to apply the principles of design as illustrated by historic costumes. Turning first to Egypt, one sees how closely here as in all countries the costume is associated with the history of its political life. The Asiatic conquests made Egypt practically supreme and with the new era of luxury, the earlier simplicity of dress gave way and more attention was paid to outward appearances. Garments became more numerous, mantles and capes were worn, elaborate head-dresses made necessary by the great heat of the country were an important part of the costume. Their decoration and color and ornamentation, which included the use of the lotus flower, the asp and many other interesting symbols, have been constant sources of adaptation in present times.

The Greeks improved on ideas acquired from the East and adapted them to their needs and social life. "The great charm of Greek drapery is in its subtle suggestion of the contours of the body. While simplicity predominates in the straight lines, giving a sense of nobility, the costume of the year 1000 A. D. is typical of several centuries and in it the general contour which has an obvious relation to the body is good and the design depends on long simple lines to give it dignity while variety is furnished by the inner sleeve and girdle." The gowns of about 1300 A. D. introduced more features of design, in contrast of line in a horizontal support of the mantle and a rythmic movement in the curves. Unity is emphasized by the long mass of the front and the outlines of the mantle. Later costumes, those of about 1370 show a beautiful feeling for structural form and more imagination in decorative detail. The shape of the neck and the bottom of the overgarment repeat each other, while the design on the hips lend variety. Coming to about 1500 we have the type of costume that has an artificial or decorative structural basis. The upper part follows the body, but the skirt has no relation to human form. There is unity in character of masses of sleeve and skirt and collar with the point of the bodice. That of 1600 shows the farthingale or wheel effect which is almost pure design, the big masses are harmonious and are decorated by radiating lines of the skirt. That of 1700 gives a good example of radial unity and line with variety in decorative detail. The second illustration of 1700 type is a good design in a period of exaggeration. The Empire Costume again changes the form of the big masses, with the smaller parts having a charming relationship of unity and variety. The 1831 costume is a reversion to the artificial silhouette. In 1879 there is an attempt to return to the natural silhouette with somewhat of a failure. The garment is poor in design, without unity in line or mass. In 1900 and in types between there are some improvement but they are not beautiful." Thus can the characteristic period garments be studied not only in themselves but, as I have tried to show, as illustrative of the principles of design.

Such work has involved the use of much reference material by the student and as Mr. Arthur W. Dow has said, "Contact with the best works of art is an essential part of art education for from them comes power and the stimulus to create." After study and analysis of such material, even tho the student for the present only traces characteristic garments of the Egyptians, the Greeks, the Gauls and so on to the present, she will, I believe, acquire some feeling for line, some appreciation and perhaps inspiration for creative work when the work is brought down to the modern, where her practical application is to be made. I do not mean original work in the sense of something new, for there is nothing new. I mean rather a new presentation of an old idea, an adaptation of the old to suit the demands of the present, an interpretation of the "feeling" of the historic costume into something which is the student's own.

(*Concluded in August*)

THE NEED AND VALUE OF SHEET METAL WORK IN THE HIGH SCHOOL

W. H. Schneider, Jr., Instructor in the Lakewood High School, Lakewood, O.

The purpose of sheet metal work as a shop subject in the high school may be stated under three general heads: The first purpose is to give the student who is preparing to enter the industrial field a comprehensive idea of the vast amount and kind of work in the trade, of its importance in the building industry and of its standing in the manufacturing field.

Sheet metal work is extending more rapidly every day and in the near future it will be one of the largest of the trades in the industrial field. In building construction practice of today where the larger buildings are being built, fireproof, an appreciable part of the initial cost is involved in the sheet metal work. The modern fireproof building has sheet metal window frames and sash; doors and door frames are made of sheet metal; and skylights, ventilators, cornices, roofs and conductors are commonly constructed of the same material. The modern types of heating and ventilating systems require literally hundreds of feet of sheet metal pipe for the hot and cold air ducts.

Sheet metal plays an important part in the building of steel passenger cars, particularly sleeping and dining cars. Practically all of the inside finish of railroad coaches is made and erected by sheet metal workers. In the building of ships, there is a vast amount of sheet metal work from the keel to the smoke funnel. In the miscellaneous manufacturing field, sheet metal is playing an important part. Office equipment, including such items as desks, filing cases, etc., are made of metal and it enters into hospital equipment such as trays, tables, medicine cabinets, etc. The adoption of state laws compelling factories to properly guard belting and gearing on machinery is just one detail of the wide range of work which is opening to the sheet metal worker. The housewife can hardly conduct her kitchen work without using innumerable articles in tin and aluminum wear.

It can be readily seen from the foregoing that when the student has become acquainted with the facts of the sheet metal trade he knows something worth while about one of the most important branches of industry.

A second purpose of the work is to acquaint students with the materials and the methods of construction in sheet metal. From my experience as an instructor, I find that practically no student knows the different sheet metals by their proper names. It is not uncommon for principals, superintendents and instructors in other branches of work to refer to galvanized iron as tin and to speak of stove pipe made of common black iron as tin piping. The high school student of today should know something about the different kinds of sheet metal; he should know what they consist of; how they are made; their uses; their durability, etc. In the woodshop of the school, he is taught the different kinds of wood, their properties and uses; in the forge and machine shops he learns the difference between iron and steel and their uses. Why should he not learn also in a shop of the school, the different sheet metals and their uses?

The methods of construction in sheet metal are unlike those of other metal working processes and differ materially from those in wood working and in the manipulation of other materials. The machinery which is used is operated largely by hand and a greater number of hand tools is used. Taking it as a whole, I find that students with rare exceptions, are entirely ignorant of the name and use of the tools, or the machinery employed in working sheet metal. It is the common experience that students look on in wonder and surprise when they see for the first time, a piece of metal formed in a specific shape by using the folder and forming rolls.

The methods of construction in sheet metal are quite as important in their general application as are those in other types of manual arts work. It is especially valuable that the student should know something about the joining of two pieces of sheet metal, the different kinds of joints, their proper names and how they are made. An important step in sheet metal work is that of soldering, and it is not only worth while for itself, as a student may be able to use it, but also as a general process in working materials. It is an accomplishment well worth while for the boy to be able to repair a tea kettle or a wash boiler at a critical time. It should be added here that soldering is not as easy as it looks, but requires some skill. I have seen many good sheet metal workers who were poor at soldering because they were never taught in the right way.

A third purpose of sheet metal work is to help the student to decide whether he is adapted to handwork or to machine work and to develop in him the power of imagination. When a student is looking at a piece of work he must be able to imagine how the different parts will fit together, how the object will look when it is complete, and what the piece will look like when they are formed in the shop. The laying out of sheet metal work involves details which afford the student his first and only application of construction drawing. It is an unusual student indeed who is not interested at the very start in laying out sheet metal jobs just to learn how a piece will look when it is formed into shape and when the definite purpose of the drawing has been arrived at.

Outlines for First Year's Work.

Following is an outline for a first year's shop course in sheet metal work in a high school. The work can be accomplished in one term of 36 weeks, in which the students are allowed three hours per week in the shop.

Sheet metal work as an industry:
- a. Its value.
- b. Its importance in the building trades.
- c. In the manufacture of articles of sheet metal.
- d. Its value as a vocation.

Metals to be used:
- a. How they are designated.
- b. Their composition.
- c. Various uses.

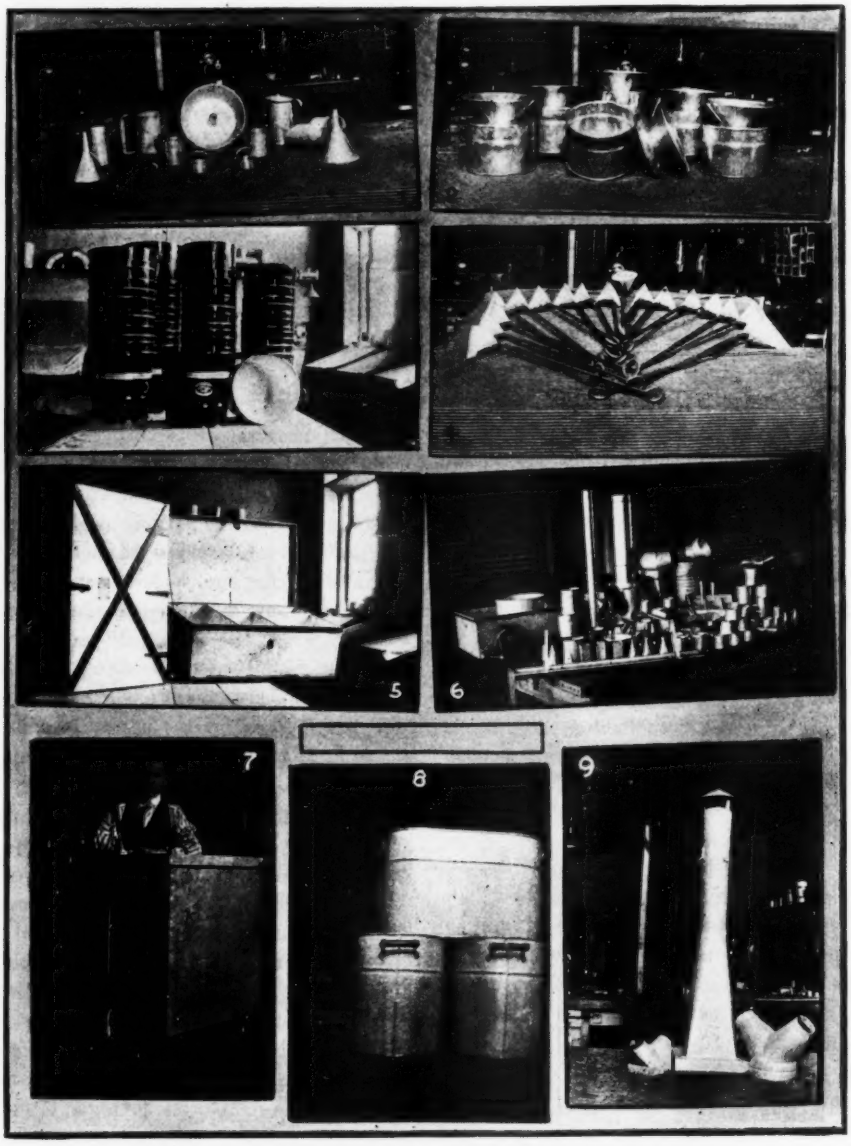
the snips, introducing the circle snip and squaring shear.

3rd Ex.

Methods of joining two ends of a piece of sheet metal together.

Name and use of the folding machine and rivetset in the construction of a

$\frac{1}{8}$" lapped and soldered joint.



SHEET METAL PRODUCTS MADE IN THE ALTOONA HIGH SCHOOL.

1. Articles made of tinplate. 2. Ticket Boxes for High School Lunch Room. 3. Waste Cans used for waste paper in classrooms. They are made of No. 28 galvanized iron, painted with black asphaltum varnish and striped with aluminum bronze. Made in last three months of term by first year industrial-course boys. 4. Dippers for the forge shop. 5. Mess Equipment boxes made for boys in the U. S. working reserve. Made of No. 24 galvanized iron, with two 1" by 1" wrought iron bands around top and bottom. 6. Miscellaneous articles for home use. 7. Galvanized box. 8. Ash cans for the use of the janitor. 9. Simple pipe developments and chimney extension.

Use of the following hand tools and their names.
Hammer, center punch, scriber, dividers, steel square, straight snip, mallet, and chisel.

1st Ex.

To lay out 3 straight line figures and to cut them out with the hand snips.

2nd Ex.

To lay out 3 curved line figures and cut them out with

$\frac{3}{16}$" grooved seam with hand groover.
$\frac{3}{16}$" grooved seam with machine groover.
$\frac{3}{16}$" corner seam.
$\frac{3}{4}$" lapped and riveted joint.

Use these pieces for practice work in soldering.

4th Ex.

Use of the soldering copper.
- a. Why and how it should be tinned.
- b. How to make an acid brush.

c. How to prepare the muriatic acid for soldering.
d. The metals on which acid is used for soldering.
e. The use of rosin and the material it is used on.

5th Ex.
Name and use of the forming rolls and cornice brake.
a. To make a straight cylinder using the $\frac{3}{16}$" grooved seam.
b. To make a square prism using a $\frac{3}{16}$" corner seam.
c. These articles to be soldered.

6th Ex.
Introduce hemming and recessing on the following projects:
a. A round cake cutter.
b. A diamond shaped cake cutter.
c. A heart shaped cake cutter.
d. Other shapes that are deemed practical.

7th Ex.
Test for knowledge of the work that has been covered.

8th Ex.
Demonstrate wiring.
a. Why a piece of work is wired.
b. The amount of metal required to cover the wire.
c. How the wiring is done. First by hand, and then with the wiring machine.

9th Ex.
Making a tin cup and taking up the new operations as:
a. Turning with the burring machine.
b. How to find the size of the bottom.
c. Double seaming the bottom on to the body of the tin cup. Explain the relation of the principles involved in the tin cup to those of any similar piece of work.

10th Ex.
Making a varnish or shellac can.
Making paint buckets or anything that might be of use to the school district or student and in which the principles already covered are involved.

11th Ex.
Construction of a box or can in one piece with the corners lapped and riveted. This exercise can be developed in a project such as a tool pan that might be used in one of the other shops, or a pan or box that the student can make use of.

12th Ex.
Test for knowledge of subjects covered.

13th Ex. Radial development.
Demonstrate difference and relation of radial development to that of straight line development.
1st Fig. To divide a circle into an equal number of parts with the dividers.
2nd Fig. To lay out the stretchout for a cone.
3rd Fig. To lay out the stretchout for a pyramid.
The method of forming and putting them together.

14th Ex. Section of a cone and pyramid.
Show the relation of the section of the cone and pyramid to the full cone and pyramid, also the relation of the section of a cone to that of a bucket, waste can, funnel, pint measure, or any piece of flared ware.
1st Fig. To lay out the section of a cone to be used as an acid cup holder.
2nd Fig. To lay out the section of a square pyramid to be seamed on the corner.

15th Ex. Project work for use by the district.
a. Waste cans for waste paper. To be used in the schoolroom.
b. Scrub bucket.
c. Dust Pans.
d. Garbage and large waste cans.
e. Any other work that you know your students are capable of doing.

16th Ex. Sections.
a. Section of a cylinder with the cutting plane at an angle.
b. Section of a square prism with the cutting plane at an angle.
c. Section of an octagonal prism with the cutting edge at an angle.

17th Ex. Section of a cone with cutting plane at an angle.
a. To make a pint measure.
b. To make a flour or sugar scoop.
c. To make a scoop for a pair of scales.

18th Ex. Intersections on pipe work.
a. Tee joint.
b. Intersection at an angle of 45 degrees.

Possibilities of a Definite Course.

The possibilities of a definite course in sheet metal work are as great, if not greater, than those in some of the subjects included in the traditional manual training courses. In the high school it is possible for the average student to attain a very complete view of the sheet metal industry and a high degree of efficiency in the making of tin and galvanized products in the course of one term of 36 weeks. During that time he can become familiar with seaming, riveting, and soldering, sheet metal with the development of the common pieces of tin work, such as cake cutters, funnels, boxes, tin cups, buckets, etc.

In schools where boys are permitted to specialize and continue their course, the problems can be continued in commercial work including pipe and hot air work, roofing, ventilator, cornice and skylight work. In any of these lines of work a well rounded high school course will offer principles and methods of work which practically no apprentice has an opportunity of learning while serving in the shop.

Sheet metal work offers the students great opportunities for putting into practice the principles of mathematics, especially those learned in mensuration and in geometry. The work is a decided help in the experience of teachers in mechanical drawing, because the students are helped to see more clearly the relations between different views of an object and the relations of line to line.

Sheet metal work is not necessarily an expensive subject to introduce or to teach. It may even be made a paying proposition if there is a careful correlation of the problems with products which the local school needs. The initial cost is not high either for machinery or tools. The accompanying photographs and the list of articles made in the Altoona high school will give some clue as to the possibilities for making articles useful in the school.

(Concluded in August)

ART EDUCATION AN ESSENTIAL IN AMERICAN INDUSTRY.

ART is a national industrial asset. Our chief commercial rivals are all in advance of us in this, and are even now actively striving to increase their lead.

In individual business the possibility of great supremacy—in the use of scientific devices, in efficiency in production, in economy in materials, in the development of profitable by-products—no longer exists. Beauty in design remains practically the only possible means of achieving an individual triumph.

In the social-industrial problem art plays an important part. The labor turnover is the most serious "leak" in the industrial system. Of the measures tending to stabilize labor, none is of greater weight than that of adequate housing. At the very heart of this lies the esthetic appeal—one of the most potent resources. In more ways than one is the remark of William Morris freighted with truth: "Art is the expression by man of his pleasure in labor."—*George C. Nimmons, Architect, Chicago.*

INDUSTRIAL-ARTS MAGAZINE

Board of Editors

E. J. LAKE S. J. VAUGHN

W. H. HENDERSON

EDITORIAL

PRINCIPLES TO BE RETAINED.

For two years and more our eating and drinking, our talking and thinking, our music and art, our agriculture, industry and education, and in fact, all our customs and methods of life have been radically modified to meet a great emergency and to win a world war.

The war has been won, and in a sense, the emergency is over. It is time now to turn every thought and effort to the pursuits of peace and to the problem of removing some of the inequalities of life and of making life itself richer and stronger for the task-fraught days that are to come.

The experiences of the past few years have permanently modified some of our theories and many of our practices. In so far as we shall dwell upon these experiences, it should be our purpose to extract from them those principles and practices that deserve to live by virtue of their proven strength and wisdom.

Our summer courses this year should be materially different in some respects from those of the past two summers. Formerly, they pointed toward struggle and conflict and the noisy clash of material strength.

This year they will discover principles of justice, discuss the invincibleness of righteousness, and undertake to formulate definite programs to meet the new needs and the modified points of view.

However, in undertaking to forget or ignore certain aspects of the war-time experiences, considerable care must be taken not to slump into some of the inefficient, time-squandering, material wasting practices of pre-war times.

Let us forget, as far as possible, something of the hideousness of the struggle, but retain and cherish the vigor and spirit of its prosecution and apply them with equal ardor and effectiveness to the reconstruction problems that now face us.

THE RESPONSIBILITY OF TEACHING ART.

Of the teachers of the various subjects in our schools the teacher of art has the least developed subject and the most varied application of work. Art applies to so many activities and has so few specific limitations that it requires a broad training and resourceful initiative on the part of the teacher of art to meet the demands of his profession. Of late years we have heard so much emphasis on applied and Industrial Art in distinction to the socalled Fine Arts that many art teachers have become confused with problems and obligations.

When it is evident that any one subject bears upon a great variety of efforts in school work the danger lies in attempting too much rather than too little. The art instruction in our schools has become the victim of this diversity of application. In the effort to make application of art to a great variety of interests we have attempted a little of this and a little of that with superficial results. There is but one remedy for superficial variety in art instruction. The remedy lies in the reduction of kinds of application and a strict adherence to a certain few fundamental principles. After all it is imperative that the designer of anything that is to look well must have in mind those elements of balance, harmony and propriety that are common to all good design. Let us teach the recognition and appreciation of these elements.

REAL AND IDEAL.

We have attended the conventions of the year. We have listened thru the programs that should have been remarkable in their direct, forceful emphasis of great needs in our development of the schools and the instruction given in our schools. We have noted the emphasis put upon "reconstruction" by the program makers. We have been a little disappointed in them. Our disappointment has not been in the lack of entertainment or inspiration for the teachers that have sacrificed time and earnings to attend the meetings but in the lack of fundamental well expressed experience in the programs.

Of course a convention program cannot offer thoro training in any one or several school subjects of instruction but it can be and should be more than an entertainment and an inspiration.

Probably there is no subject of instruction which needs the balance of understanding more than Industrial Art. The relations between art, education and industry are but poorly understood. Teachers must be informed by those who have had experience. One of the best addresses we have heard on this subject was given by a well educated and successful businessman who told the assembled teachers of art in a direct and businesslike manner of his experiences with the product of school instruction who applied to him for employment. This speaker did not attempt to tell teachers how to teach. He did not ridicule the present methods of instruction or the products of instruction. He stated clearly and in his own terms a few fundamental accomplishments which must be acquired by the candidates for employment as designers of industrial projects. "They must have a developed sense of proportion." "They must be trained to recognize harmony in forms, values and colors." "They must know the forms of past art in order to develop modern forms."

"They must have the ability to express their impressions thru exact, definite draftsmanship that can be interpreted in terms of materials and methods of manufacture."

This speaker said not a word about originality. He was wise enough in the ways of design to know that the spark of genius which appears so seldom to the teacher must be fed by substantial understanding and well trained ability before it can become brilliant.

One other address stands out in our mind in strong contrast to the substantial one described. This speaker began his remarks by the assertion that "art consists only in the spontaneous and complete expression of a unified impression." "A perfect thing of original conception and subconscious execution." A few doubtful illustrations were skillfully presented to lead the audience to realize the high standard of a perfected art.

We are reminded of analogy between religion and art. The analogy applies to instruction in these great subjects. What preacher of today is satisfied with emphasis upon the ideal? The problem of the preacher and teacher is to develop conditions rather than to point in a self-satisfied sanctity to an ideal that has never been accomplished and which when fully conceived is liable to discourage rather than to help.

MECHANICAL DRAWING IN THE GRADES.

THERE seems to be a rather widespread notion that the processes of inking, tracing and blueprinting have no place below the high school, and yet we have heard no valid objections urged against them.

If it be contended that they should be ruled out because the instruments are difficult to use and because the work done by seventh and eighth grade boys would be poor, it may be answered that almost every subject and activity in the curriculum could be ruled out on the same identical basis.

There is scarcely an argument for such work in the freshman year of high school that will not apply with equal force to the eighth grade. In fact, the average age of eighth grade boys is but slightly below that of the freshman high school boys.

The fact that the work might not be of a high standard is not of itself a proper criterion by which to be guided. To judge of the value of school work simply by the results that appear on paper or on wood or metal is neither a correct nor a fair way to arrive at a conclusion.

However, it is the testimony of those who have tried out the plan of having seventh and eighth grade boys do some inking, tracing, and blueprinting, that they do the work remarkably well, that it arouses a much greater interest in the subject of mechanical drawing, and that it materially strengthens their work later in high school.

BAD LETTERING AND ITS CAUSE.

To one whose task it is to examine great numbers of mechanical drawings, the almost universally bad lettering becomes quite distressing. It is a very common experience to find an otherwise good drawing hopelessly marred by poor lettering.

We are wondering whether this is not the legitimate fruitage of the usual method of attempting to teach lettering. Is it too much to lay this fault at the door of that inevitable and immutable first plate in mechanical drawing where the student with slow, laborious, cramped and shaky hand forms rows of a's and b's and c's and z's? It is doubtful whether anyone ever learned to letter in that way.

The attempts to produce good looking "plates" by the tortoise and tortuous method are probably responsible for more bad drawing than any other one thing? It would be infinitely better to have a beginning student make a number of plates as well and as quickly as he could and throw them into the waste basket than to spend a large amount of time and nervous energy laboriously working out a "plate" to be submitted and preserved "as evidence." Skill and facility are control and freedom gained thru practice and repetition, and woe unto the person who finds himself in the grasp of those slow, rigid methods of procedure so common in the early part of mechanical drawing courses.

THE SALARY DUTY.

THE causes which have led to the present discontent of teachers with their salaries are numerous and while they are to be traced primarily to the economic upheaval created by the war, the inflexibility of our school laws contribute much to the difficulty of the situation. School boards have not been evading the question when they have pointed out to teachers the fact that the tax limitations set by statute have prevented adequate increases.

Every teacher has a threefold duty to perform in advancing the cause of adequate salaries. In first line is his duty to himself and, if he be married or have dependents, to his family. This is so evident that it need not be argued.

The second duty is to his profession, and while it may seem remote as applied to salaries, it is proximate and very real. Unless salaries are promptly restored to the corresponding level which they occupied in relation to the cost of living and the average wage paid in other occupations, previous to 1914, the present shift of shop teachers into the industries will grow. This will inevitably result in the lowering of teaching efficiency and of professional standards. It will mean that teaching as a life occupation will become increasingly less desirable and stable. The number of men and women who enter it will be reduced and to overcome in part the shortage of the supply, the preparation and the initial efficiency now required will be reduced.

The effect of lowered teaching standards will have their inevitable influence on the schools, to which the teacher owes his third duty. As is the teacher, so is the school, is still a truth and more important than ever. At no time has it been so necessary that the schools be efficient as instruments to maintain our institutions and our national life. For democracy has become a world aspiration and the schools cannot be backward in promoting it.

Active participation in the discussion of salary problems is the duty of every teacher for purely professional reasons.

THE WESTERN ARTS CONVENTION

Exit: W. D. M. T. A.
Enter: The Western Arts Association.

Briefly that is the story of the 25th annual convention of the manual training, art and household arts teachers, held in Chicago, May 6 to 9. To characterize the meeting as an unusual success or as signaling a new post-war era in manual or household arts would be an exaggeration of the truth. Conditions resulting directly from the war made the program decidedly lopsided and reduced the attendance, but there were sufficient high spots in the way of informational papers and discussions that made the audiences thoroly satisfied with the sessions. The single criticism that can be made is due to the fact that the program opened on Tuesday afternoon and did not close until Saturday noon, altho it might easily have been compressed into three days without omitting a paper.

Prof. Ira S. Griffith made a delightful president and his opening address set the keynote for the meetings in discussing current changes and advances in the practice of the manual and household arts. The feature of the opening meeting was the address of William B. Owen, principal of the Chicago Normal College who spoke on "Controlling Ideas in Educational Reconstruction" and who vigorously condemned the inflexible, self-satisfied attitude which many educators take in discussing educational reforms. The upheaval in social, political and economic conditions which has followed in the wake of the war will not leave education unchanged and the schoolmaster must do his share in the reconstruction unless he is to be engulfed.

Dr. Bobbitt's illness, on Wednesday, prevented his address on the Reconstruction of the Curriculum, but the gap was filled by Prof. R. W. Selvidge's paper on "Ideals Suggested by the Experience of the Vocational Units of the Students' Army Training Corps." The efficiency of the army training classes was due, in Mr. Selvidge's estimation, to a number of contributing causes. Speed and effectiveness were largely due to the fact that there was a definite aim with a set standard of proficiency. Under army conditions, and using army methods, any trade can be taught effectively in six months. From the pedagogic standpoint the experience showed that (1) the best results in the quality and quantity of work are obtainable where pressure exists, (2) intensive work each day makes for greater results, (3) it is not economical to teach new processes in the trades to groups of more than five or six, (4) the division of training according to the division of labor as it exists in the trades makes it possible to give men limited details of a trade in an exceedingly short time, (5) the maturity of students has a decided influence on the length of training needed. Mr. Selvidge suggested that the best results in training of this kind are obtainable from classes of twenty, divided into four squads, each under a leader. Boys of 17 to 20, with high school training, who might be expected to react quickly to training did not succeed nearly so well as men between 20 and 30, who were mature and experienced even tho they lacked high school or college training. In summarizing, Mr. Selvidge declared that his experience in the army training schools confirmed the opinion that trades must be taught in the industries, under state control, while the high and trade schools must confine themselves to the fundamental elements of theory, citizenship and general information which will later create resourcefulness and skill.

The Annual Dinner.

While most business organizations make their annual dinner a gusty and gustatorial event, the association departed from custom and listened to some solid talks, after the solid food. Toastmaster W. J. Bogan did the association a distinct service thru his humorous allusions to the antagonism which is supposed to exist between the practical manual training man and the idealistic art teacher. Mr. Ralph Fletcher Seymour made an appeal for art as a part of our daily lives. Miss Ethelwyn Miller argued for the teaching of the tools of the household—the sewing machine, the needle, etc.,—in the shortest possible time so that the girl may become a creative user of the tools—an artist. Mr. Jens Jensen, who spoke on "local color" argued that American art must grow out of the soil of America, and that the schools must do their share to create it. Mr. Oliver Dent Grover urged that art be recognized in the industries and that the art teacher consider it a sacred duty to teach the value of his profession.

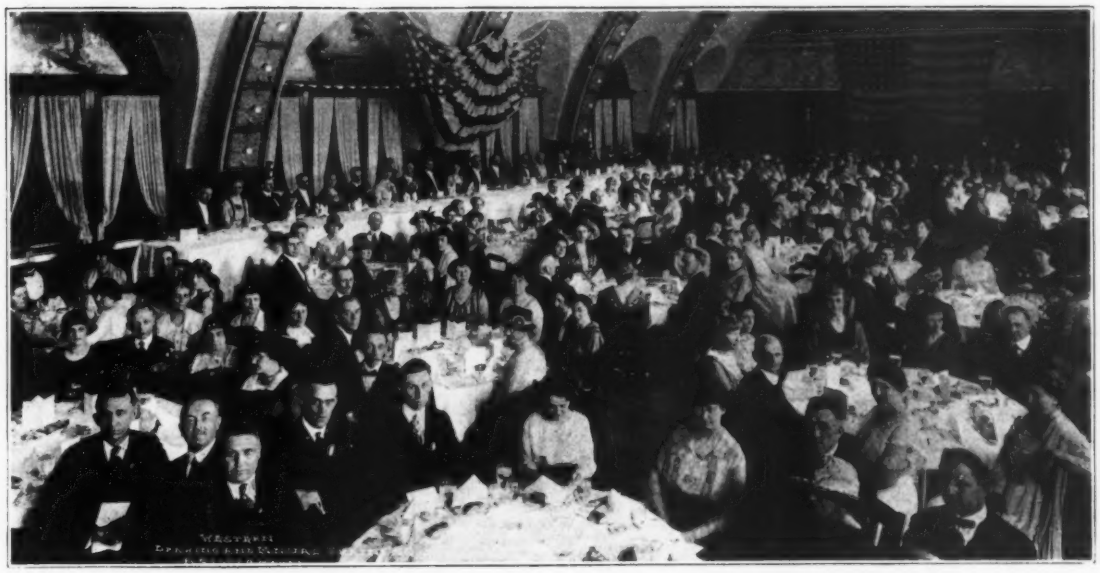
Mr. Royal Bailey Farnum of Rochester, N. Y., discussed the commercial art needs of the nation created by the cutting off of our relations with Germany and the interruption of the supply of English and French designers. America needs 15,000 designers in the industries at present. In taking up his topic, Color in Industry, Mr. Farnum showed the need of a national color system with a uniform scheme of color notation. He showed that the beginnings of such a system have been made in the Munsell color scheme. The present possibility for a forward movement in color education and color use lies in cooperation between teachers and artists.

Art occupied the exclusive attention of the general session on Thursday morning. Miss Emma Church, in her plea for a national university of the arts, sharply criticized present methods as represented by traditional art schools and museum schools and placed herself on a rather narrow platform of art instruction which would leave no room for the humanities or historic art. Prof. Charles A. Bennett described in detail his plan for a national school of industrial art and presented a very practical scheme of combining general art instruction with productive studio and shopwork. His paper showed a grasp on the historic side of modern industrial art instruction in Europe that made his plan for an American school appear plausible and workable. Mr. Lionel Robertson closed the session with a discussion of design and the modern designer in industry. He made a very clear-cut statement of what industry asks of the young designer when he leaves the art school and enters upon practical work. The paper proved to be sensible, and well tempered, and Mr. Robertson made it specific by reference to furniture designing, the study of period styles in architecture and interior decoration, etc.

Art was again the topic at the Thursday evening session which preceded the annual reception. Mr. William Gray Purcell, a Philadelphia architect, presented an intensely individualistic opinion of modern art and design and pleaded for a method in design which would discard the study of historic styles and examples for absolute originality and an individual study of each new situation and an original solution for it.

Friday Session.

War experience in teaching household arts subjects furnished Miss Edna White of Ohio State University, with a practical topic on Friday morning. She showed that the definite objects which were set up by the food, fuel and other war-administration boards, gave the teachers a specific task and made possible the application of practical methods to definite courses. She showed how it was possible in teaching cooking, sewing, thrift, etc., to obtain the proximate ends of war conservation and better household management and at the same time to develop group responsibility, a wider outlook on the duty and function of the housekeeper, some technique in the cooking, sewing and other operations and a genuine spirit of service. Miss Katherine Morris Lester of the Peoria schools, closed the session with a lecture on Greek Sculpture. By means of a collection of original photographs, she traced the history of the three periods in Greek Sculpture from the archaic beginnings to its final decline.



DINNER OF THE WESTERN ARTS ASSOCIATION AT THE AUDITORIUM HOTEL, CHICAGO.

Round Tables.

Mr. James McKinney of the University of Illinois, described the relative difficulties of training college men as vocational instructors and of educating tradesmen in the elements of the theory and practice of teaching. He showed the shortcomings of the former in their lack of practical experience and knowledge, and the difficulty of adjusting the latter to think in terms of difficulty of process rather than in terms of quantity production.

Far too scholarly and important a paper to be relegated to a round table was the address of Mr. Emery T. Filbey, of the University of Chicago, who took up "Vocational Education Versus Vocational Training" as his subject. Mr. Filbey defined the function of the vocational school as training for independence and self-adjustment in industry. He argued that vocational education should produce experiences (a) to develop technical skill, (b) thought-provoking situations, (c) commercial production, and (d) pointed information. He argued in detail for greater emphasis in all vocational schools upon habit formation, independent thought, ability to use books, etc. He argued against mere training which makes the worker machinelike.

On Friday afternoon the manual training men of the Association were guests of the University of Chicago at a conference arranged by the University and the Chicago teachers. Mr. E. G. Allen of the Cass Technical High School, Detroit, discussed standard tests in industrial arts subjects and showed the present lack of aims, methods and rules. Mr. W. F. Willard of the Schurz High School, Chicago, described in detail, the standardization of courses in mechanical drawing which have been undertaken in Chicago by a committee of teachers under the leadership of Mr. A. G. Bauersfeld. Mr. Willard argued for the broadening of mechanical drawing courses and for correlation with the shopwork and science work which the student is taking. In general, his paper showed a distinct advance in the ideals of the Chicago high schools, (1) to bring directness in teaching and practical methods in the foreground, (2) to use concrete materials, (3) to emphasize fundamental principles, (4) to conform to standard commercial practice, (5) to make the course more logical, and (6) to cooperate with the shops and other departments of the high school.

On Saturday morning Dr. W. T. Bawden of the United States Bureau of Education held a conference of persons interested in the special training offered by the War Department thru its Committee on Education and Special Training and the S. A. T. C.

The business of the Association was readily transacted. Mr. Bennett as chairman of the Committee on Nominations, offered the following list of officers for the ensuing year:

President, Miss Jeanette Buckley, Chicago Art Institute, Chicago; Vice-President, Mr. Harry Wood, Supervisor of Industrial Arts, Indianapolis, Ind.; Treasurer, Mr. Leonard Wahlstrom, Federal Board for Vocational Education, Chicago. Member of the Council, Mr. Ira S. Griffith.

Mr. L. R. Abbott, who was prevented from attending the meeting thru illness, holds over for another year as secretary of the association.

The financial reports showed the wisdom of the former officials of the association in accumulating a reserve fund. The reduced membership, the lack of a meeting in 1918 and the high costs, all resulting from the war, made it necessary for the officers to sell one of a $500 bond in order to obviate a deficit.

A number of changes were made in the constitution to bring that instrument up to date and to make it conform to the broadened interests of the membership. An important change was made in the name of the association by which the familiar, clumsy and incomplete name of Western Drawing and Manual Training Association was dropped in favor of the brief name, Western Arts Association.

The convention was attended by about 250 persons from the Middle Western states and by a considerable number of teachers from Chicago and the surrounding suburbs.

The limited exhibits which were housed in the special exhibition rooms of the Art Institute, proved to be a delightful relief from the former large haphazard displays. The small space available caused the committee to send out invitations to a selected list of city schools and to a comparatively small number of normal and art schools. Each invitation requested emphasis on the types of work in which some specialization has been attempted with success during the past year. The exhibit thus included a wide variety of work of unusual excellence and gave a very suggestive idea of the newest types of art and construction work. Except for the very excellent exhibit of Chicago, no manual training work was shown. It is to be hoped that limited exhibits will become the rule at future conventions.

PROBLEMS AND PROJECTS

The Department of Problems and Projects aims to present each month a wide variety of class and shop projects in the Industrial Arts. Successful problems are invited and will be paid for. A brief description of constructed problems, not exceeding 250 words in length, should be accompanied by a good working drawing. The originals of the problems in drawing and design should be sent.

Problems in benchwork, machine shop practice, turning, patternmaking, sewing, millinery, forging, cooking, jewelry, bookbinding, basketry, pottery, leather work, cement work, foundry work, and other lines of industrial-arts work are desired for consideration. The editors will not accept the old hackneyed problems of footstools, taborets, towel holders, etc., which have been made from time immemorial, ad nauseum.

Drawings and manuscripts should be addressed: The Editors, INDUSTRIAL-ARTS MAGAZINE, Milwaukee, Wis.

A PECK CRATE.

Fred Short, St. Croix Falls, Wis.

This crate can be easily and quickly constructed from soft wood. It is a very good project for a beginning grade class in bench woodwork if the material is gotten out by the instructor or older pupils.

The ends should be nailed to the bottom board first and then the slats should be nailed across the sides, 1½ inches apart. It may be shellaced or painted if desired.

This makes a light strong crate which holds exactly one peck. It makes a very good container for potatoes or other vegetables for sale. It is also a very good receptacle for exhibiting such produce at school or county fairs, or at school or district club contests.

A FLOOR LAMP.

Le Roy A. Prescott, Hackley Manual Training School, Muskegon, Michigan.

The design for a floor lamp that is a little out of the general run of what one usually sees in turned lamps is shown and detailed in the accompanying drawings. In lamps of this sort the bases in most cases are turned round whereas in the one here illustrated (see Fig. I) the base is a tripod affair which makes it very sure of resting solidly on any floor no matter how uneven.

Figure II is a detail of the base of the lamp and it also shows a method for gluing it together which proved very satisfactory to the writer. The clamping blocks are fastened to the floor, or any other level surface, in their correct relative position to each other, and after applying the hot glue to the surfaces to be joined, the wedges are driven in as tightly as they will go, clamping the parts together in a very effective manner. A piece of heavy wrapping paper should be placed under the base to keep it from sticking to the floor. This paper may be left as a protection to the joints as it is not necessary to finish the bottom of the base.

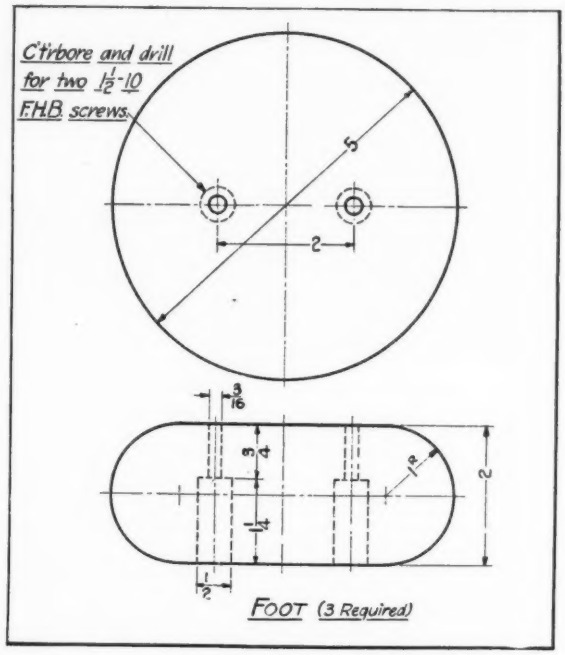
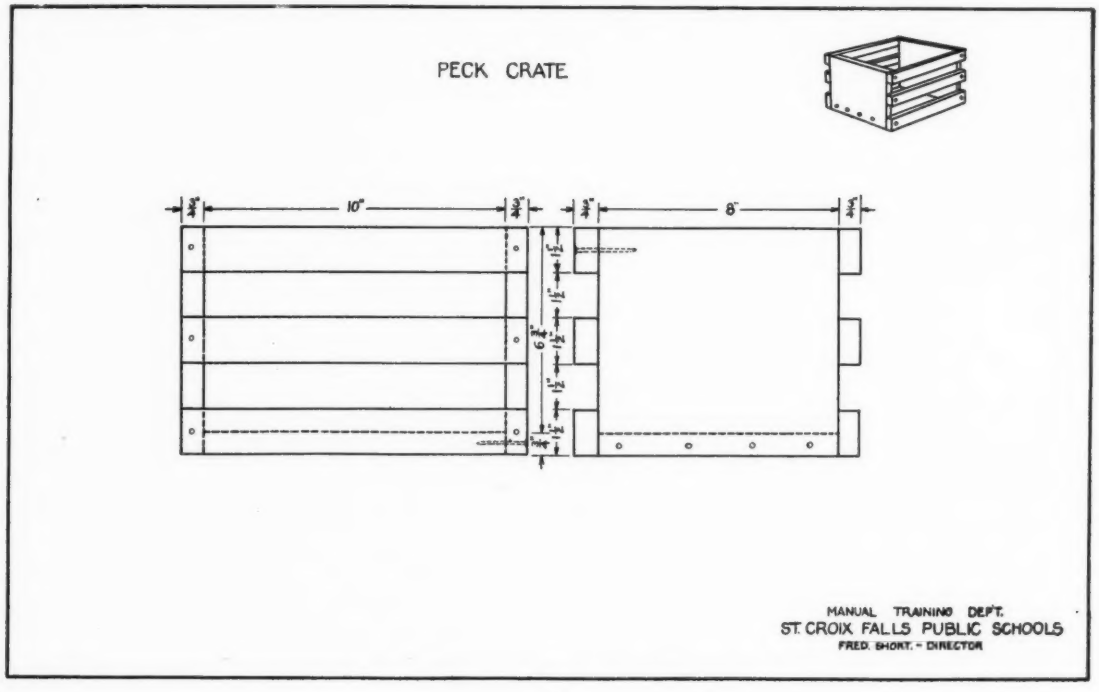


Fig. 1. Details of Foot of Floor Lamp.



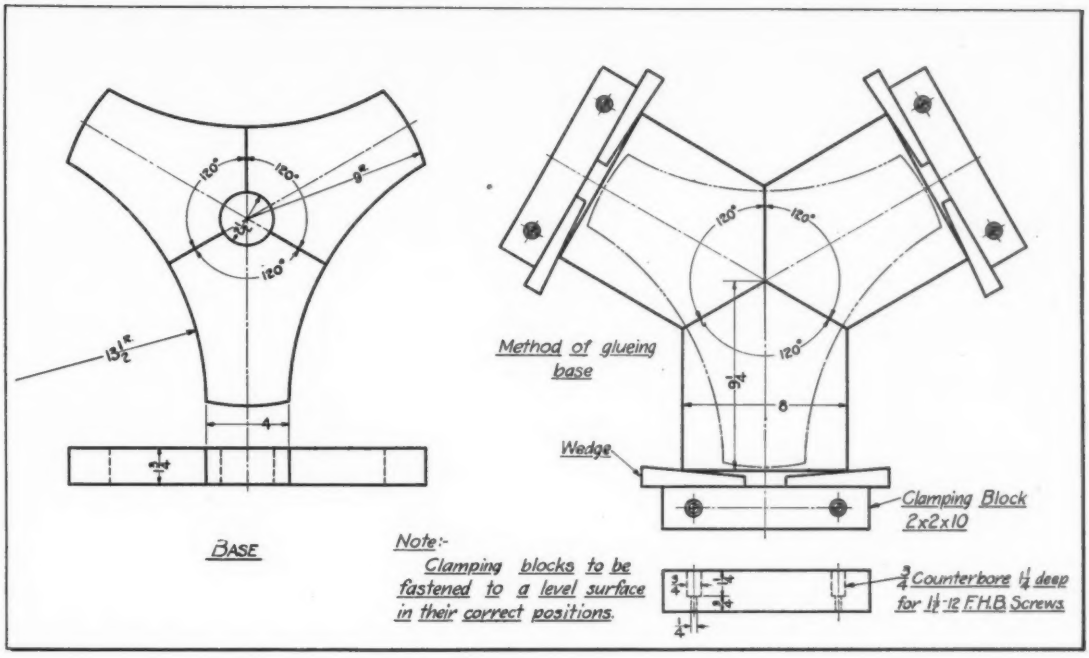


FIG. 2. DETAILS OF BASE.

Because of the wide gluing surfaces, the base being 1¾" in thickness when finished, it is not necessary to use dowel pins for holding the three segments together if they are made to fit well. However there is no objection to their use.

Care should be taken in laying out the segments so that each one has an exact angle of 120° at the center part. A good method is to take a piece of rather heavy drawing paper and lay out the angle accurately with a compass. Then cut it out of the paper and use it as a templet on all three segments. It will be noted from Fig. II that the design for the base is not cut out until it is glued together.

The post which is shown in Fig. III can be turned by using two ordinary wood-lathes which stand end to end, the tail stock being removed from one and the head stock from the other. A long tool rest will make it possible to bridge the intervening space between the lathe

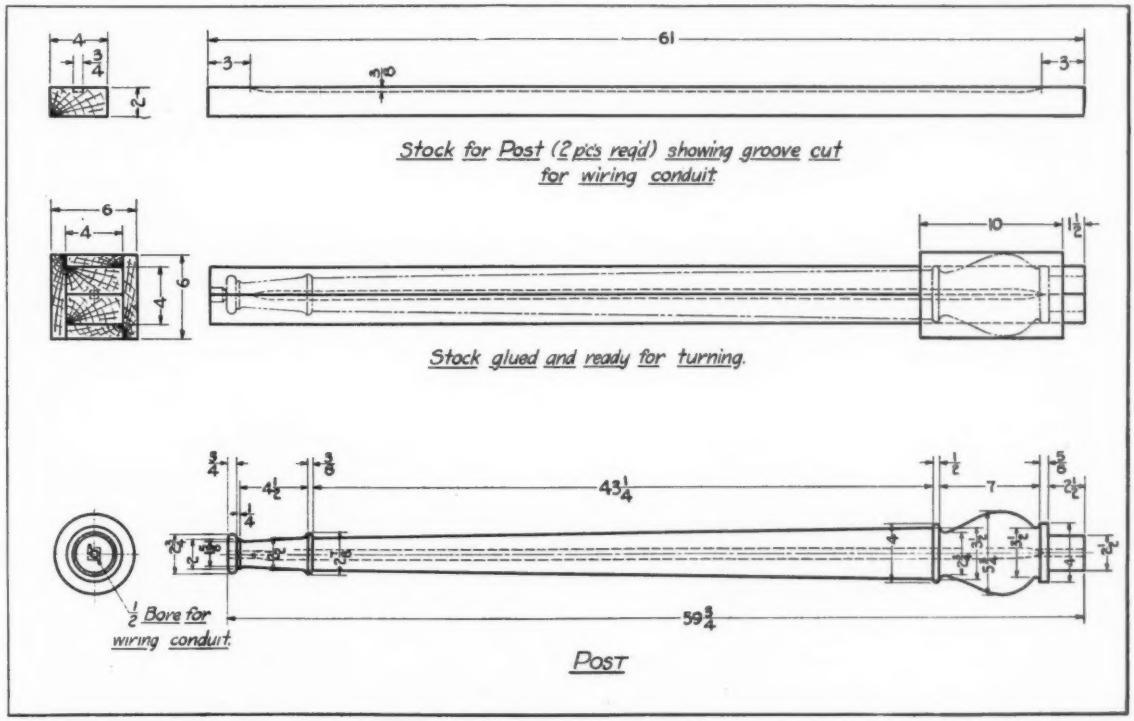


FIG. 4. DETAILS OF POST.

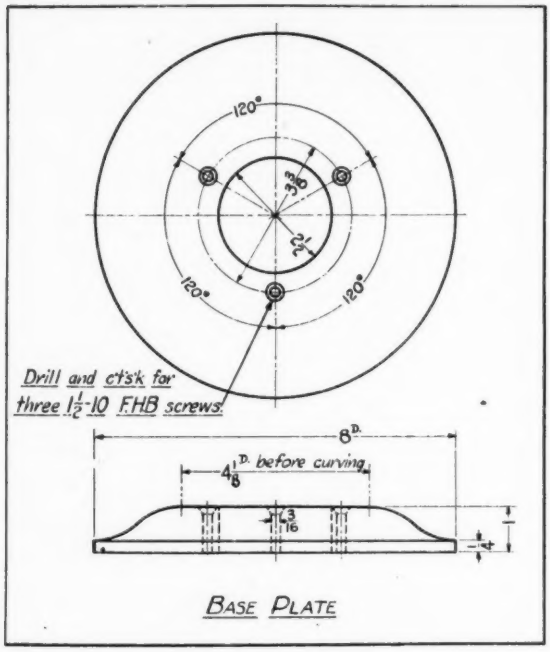


Fig. 3. Details of Base Plate.

beds. In cutting the groove in the post for the wiring conduit it will be noted that three inches at each end is not cut out. By leaving this material at the ends it is not necessary to plug the ends to make a place for the lathe centers for turning. When the work in the lathe is finished a one-half inch hole should be bored in the post at each end to complete the hole for the wiring conduit. If facilities permit, this should be done in the lathe. If this method is used instead of cutting the groove the entire length of the stock and plugging the ends, the top of the post is sure to look well, whereas if the ends are plugged there is always the chance of the plug being a poor fit and showing up badly when finished.

The designs for the base plate and foot are detailed in Figs IV and V, respectively, and show the location of the holes that are used in fastening them to the base. In putting the base plate on, one should plan to have the three screws come in the centers of the three segments of the base for the sake of any strength it may add to the construction. In turning the feet it would be well to make a templet out of some thin material, such as pine, in order to get the one-inch radius symmetrical on all three.

For material, oak, birch, mahogany or walnut is suitable for the ordinary finishes, and pine or poplar would be good if one wanted a lamp finished in ivory.

When finishing, it is well to take the lamp apart and finish each part separately, as it is easier to obtain a good finish if all the corners that result from its being assembled are eliminated.

If on account of poor drying facilities it is hard to use varnish, a finish that looks practically the same as a dull varnish rub can be obtained by using just shellac and wax. After staining the wood and filling it very carefully, five or six coats of shellac should be applied. The shellac should be rather thin and applied very evenly. Between each coat rub it down lightly with very fine sandpaper and after the fifth or sixth coat if you have a good surface it should be rubbed down for the last time with rotten stone and oil and finally waxed. The lamp can then be reassembled and the necessary electrical fixtures installed.

A bill of material, rough size, follows:

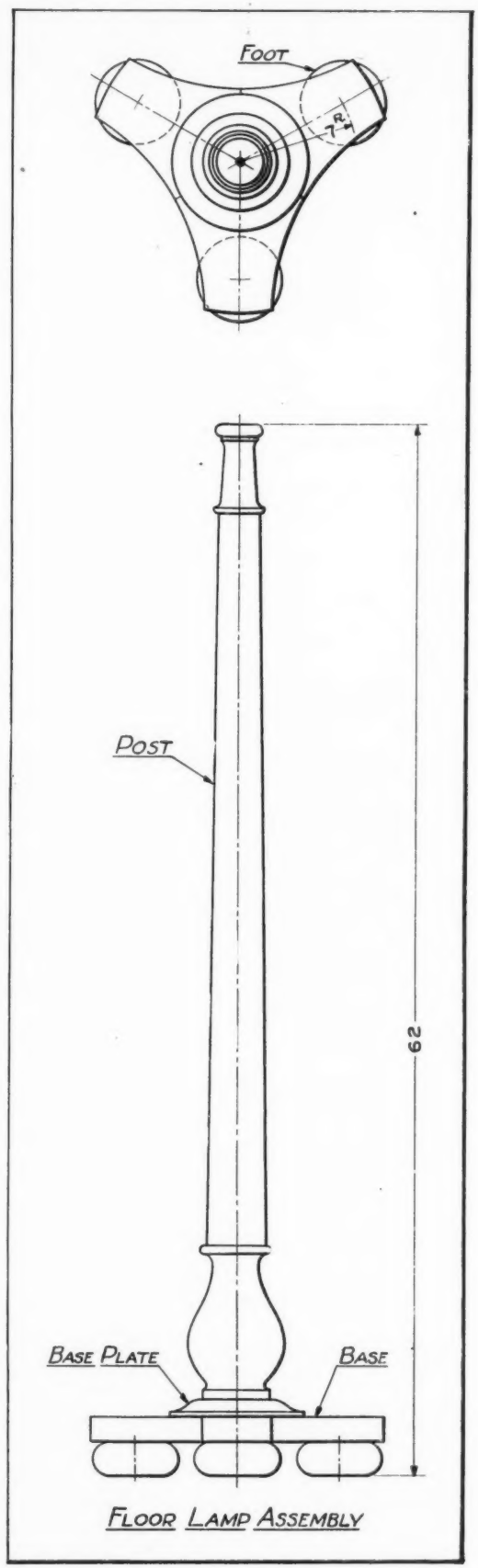
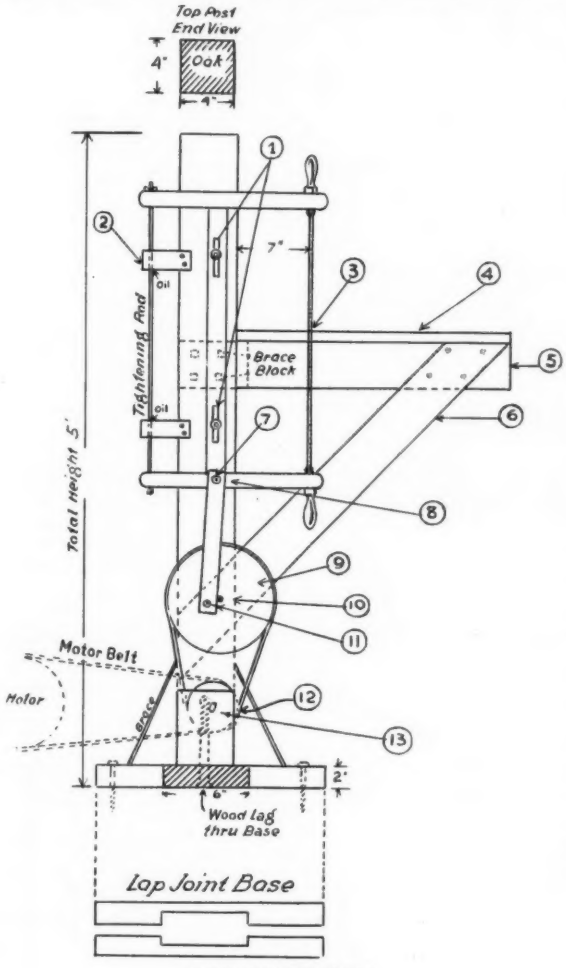


Fig. 5. Assembly of Lamp.

No. Req'd	Name	P'c's Req'd for each	Thickness	Width	Length
1	Post	2	2″	4″	61″
		2	1″	4¼″	10″
		2	1″	6″	10″
1	Base	3	1⅜″ (Finished)	8″	9¼″
1	Base Plate	1	1″ (Finished)	8¼″	8¼″
3	Foot	1	2″ (Finished)	5¼″	5¼″



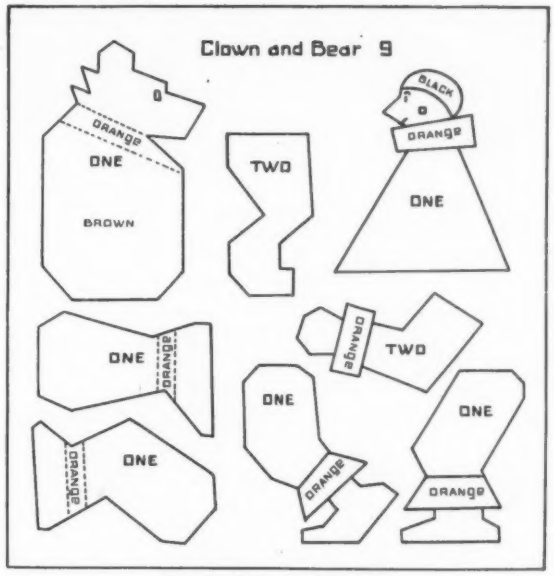
Details of Makeshift Saw.

A MAKESHIFT JIG SAW.

Don A. Sloan, Great Bend, Kans.

The accompanying illustration shows a makeshift jig saw which the writer made in his classes in the fall of 1918. There was no band saw in the shop of the schools so that it was impossible to do accurate sawing for various kinds of light work. The writer's classes took up in the fall the making of toys for the Red Cross and for local sale so that a jig saw was absolutely necessary. The saw was made entirely from material at hand in the shop, and has been found in practice to work accurately and to be sufficiently fast to serve a temporary purpose.

The entire saw is made of wood bolted and screwed together. In making a similar saw it will be necessary for teachers to arrange the size of the pulley wheels depending on the speed of the motor which they have or the speed of a shaft from which power can be taken. The speed should be arranged so that the saw will operate at the rate of 60 pulses per minute.



Details of Clown and Bears.

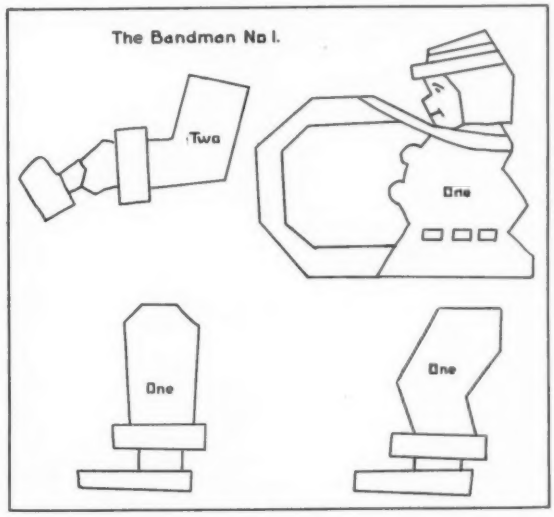
THE TRAFFIC POLICEMAN.

By K. Elizabeth Killeen, Director of Handwork, Buffalo, New York.

The accompanying illustrations are part of an interesting toy making problem worked out last summer in the vocation school of Buffalo. The toy illustrating The Traffic Policeman will give a clue to one of the pieces made by children as a part of a set of toys illustrating a circus parade. The other illustrations are typical of drawings furnished to the teachers as suggestions for working out the several pieces of the circus.

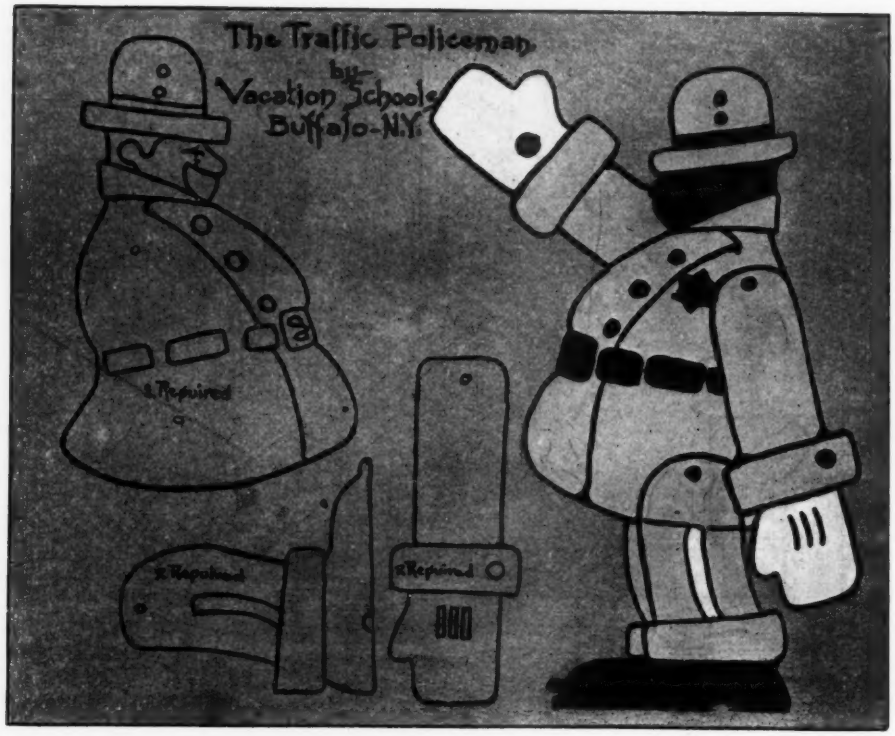
Toy making in the Buffalo summer schools is offered for boys about 9 or 10 years of age and the materials furnished are $\frac{3}{16}$″ or ¼″ basswood, pins and a complement of tools including a coping saw frame for each boy, a few hammers and three or four knives for each class of twenty. Sand paper, seven show card colors, and a half dozen small paint brushes complete the outfit.

The work is carried out in the regular classrooms on tables in the halls or in the basement rooms. The work has been found exceedingly interesting and worth while.

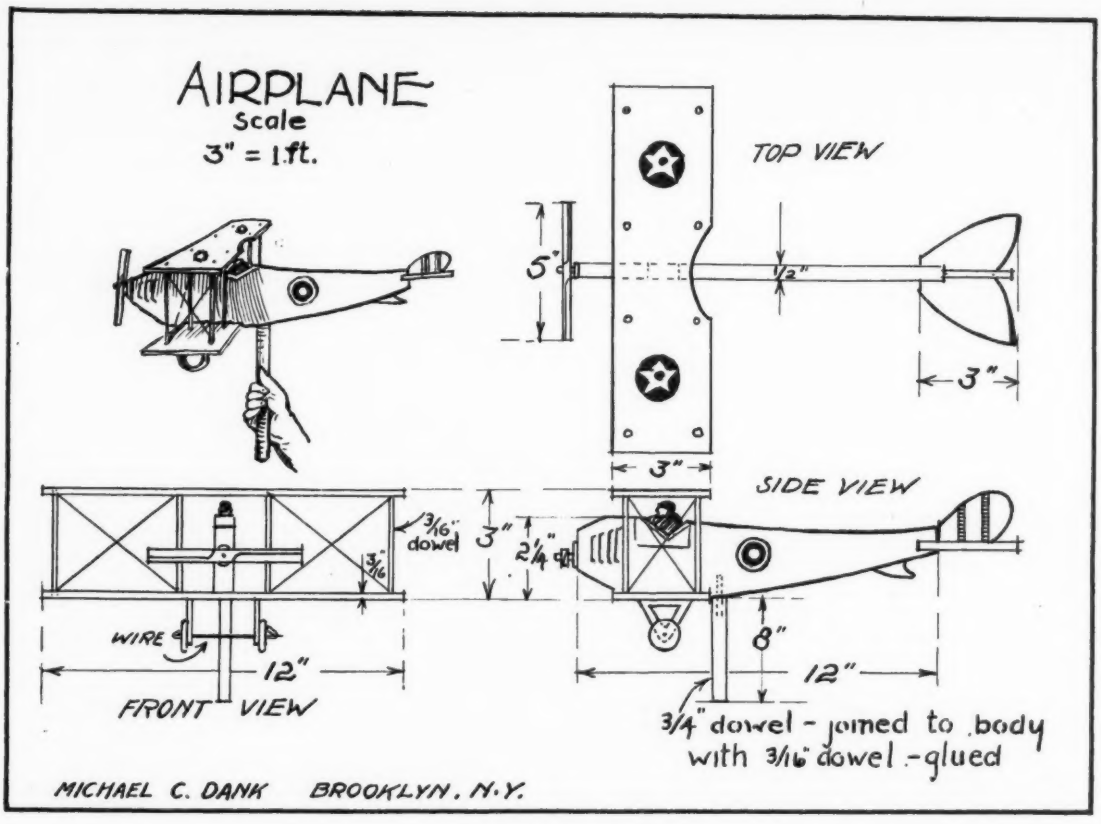


Details of Bandman.

(See Policeman on following page.)



THE POLICEMAN. (See page 287.)



DETAILS OF AIRPLANE.

THE AIRPLANE.

(As Adapted to Child Play.)

Michael C. Dank, Instructor, Manual Training, Brooklyn, N. Y.

Without doubt, the airplane in its various applications, has been found to be a most interesting project for the boy everywhere.

As most types of airplanes are somewhat difficult for the small child to make the model here presented is designed to be simple in construction tho still retaining those features which give realism to the child at play. The author has given this problem to some of his classes with most pleasing results. In a large playground near the school, the boys found great enjoyment running in the wind holding their airplanes in their hands aloft, while the propellors spun around with great rapidity.

The airplanes were painted with dry colors mixed with white shellac varnish, giving a brilliant effect. The color schemes and insignias used in decorating the problem, were individual with the child.

This project can be very easily used as a weather vane by enlarging the dimensions of the different parts and by substituting a long pipe or pole in place of the small hand-piece. The weather-vane can be wired to a roof with attractive effect.

A PRACTICAL SAW RACK.

De Witt Hunt, Supt. of Shops, Oklahoma A. & M. College.

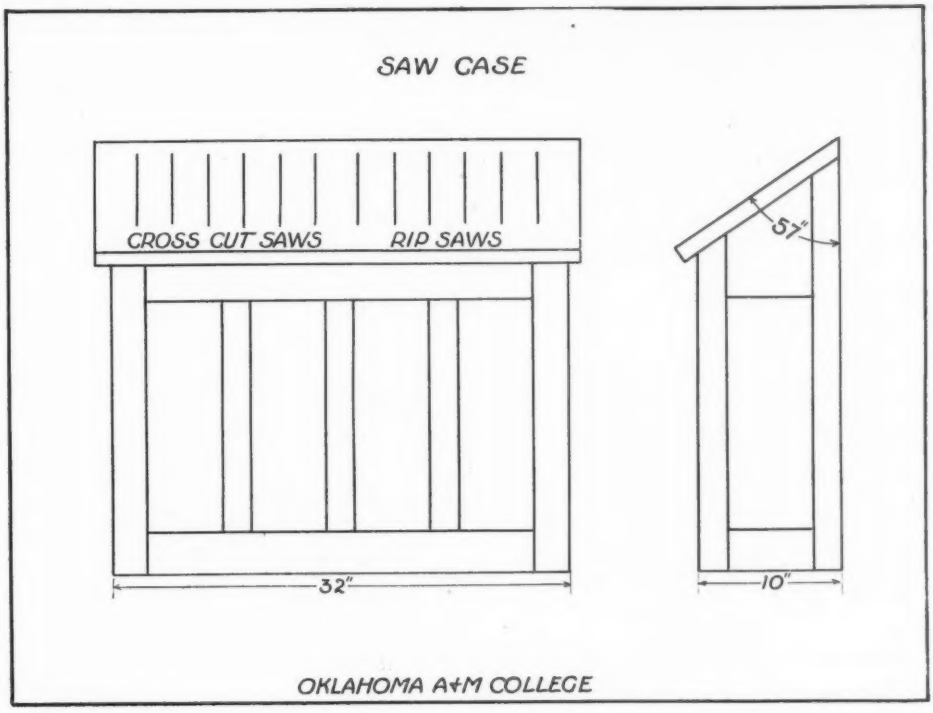
Several designs of saw racks have been published in the *Industrial-Arts Magazine* during the past year. I wish to submit the drawing and photograph of one that has been in use for several years. The top is made by sawing off a narrow strip from the top edge and the kerfs for the saws are cut on the band saw or small circle saw. The narrow piece is then glued and screwed back in place.

PLAYGROUND WORK IN BALTIMORE

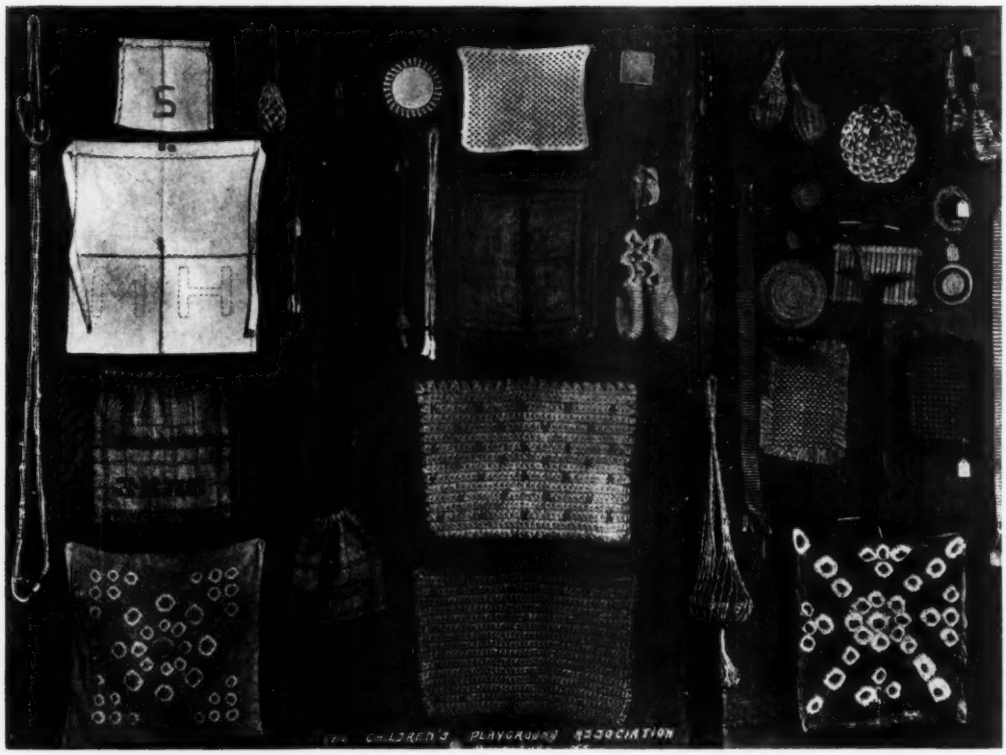
The accompanying illustrations are representative of toy making and handicraft work carried on in the Baltimore summer playgrounds. The articles were made during the summer of 1918 and are suggestive for any community where summer schools and playgrounds are conducted.

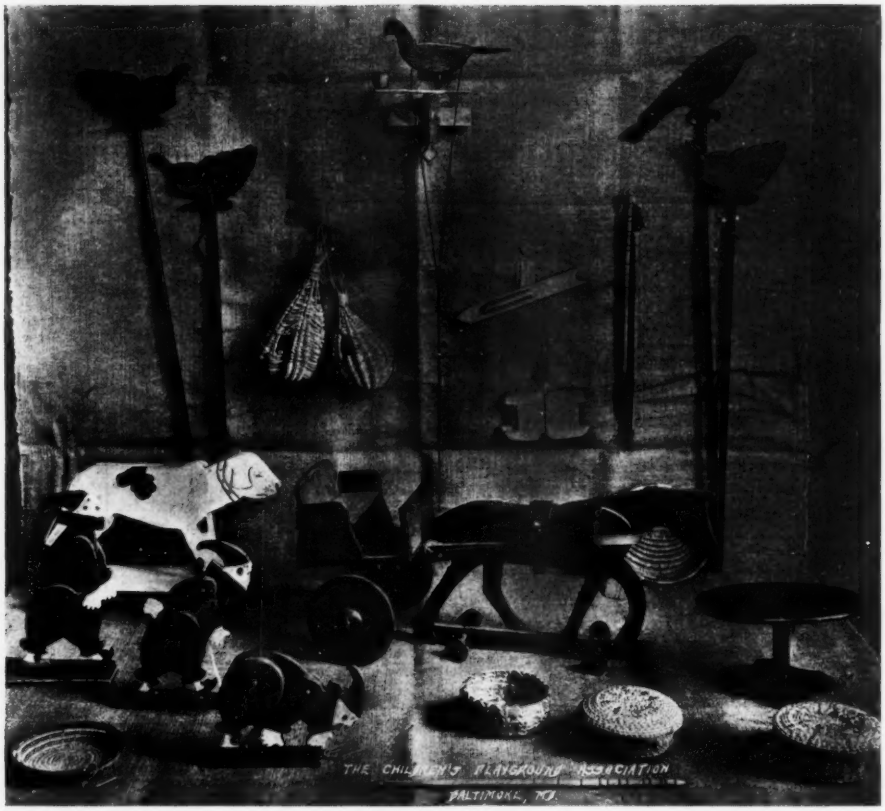
(*Concluded on Page* 291)

The Saw Case in Use.



DETAIL OF SAW CASE.





TOYMAKING AND HANDICRAFT WORK OF THE BALTIMORE CHILDREN'S PLAYGROUND, 1918.

(See pages 289-291)

(*Concluded from Page 289*)

In Baltimore the playgrounds are managed by the "Children's Playground Association" of which Miss Mary B. Stewart is secretary and Miss Margaret E. Haydock is supervisor of handicraft.

In carrying the Handicraft work on the Baltimore playgrounds, an effort has been made to choose only such things as are suited to outdoor work, primitive crafts, inexpensive and simple materials and equipment.

The work has been carried on from 20 to 30 playgrounds and, tho there is always a certain amount of waste material as well as unfinished and neglected work, the expense to the association is really quite small. Each child finishing an article is encouraged to purchase it at cost, so that on some grounds the cost of supplies is covered, leaving the equipment and tools the main expense.

For several years Honors—ribbon badges—also certificates have been awarded the children doing really good work The different playgrounds have competed for honors too. The Honor work became the property of the association.

This past year a new plan was carried out, the association purchased certain articles which were especially well made; the child, after paying for his material, receiving the profit. It was thought thru asking the child to pay for his materials to teach him some idea of the value of hand work by putting a price on his production—if it really had a value. So far the plan has seemed successful.

The Leaders of the playgrounds who have charge of this work receive their instruction in this, as well as the other activities, thru the training school of the association.

The illustrations are shown thru the courtesy of Miss Haydock.

NEW BOOKS

The Law as a Vocation.

By Frederick J. Allen. Cloth, 83 pages. Price, $1, net. Harvard University, Cambridge, Mass.

The author presents an attractive picture of the legal profession as a desirable vocation. He has, what the few writers on the subject who have preceded him, have lacked: a keen insight into the purely vocational phases of the subject. In this his experience as assistant director of the Bureau of Vocational Guidance at Harvard has been invaluable. The book takes up, in logical sequence, the field of the law, the service and opportunities of the profession, the preparation for the profession in the way of general and professional education, admission to the bar, professional methods and practices, fees and income, tendencies of the profession. The author has an incisive style and a happy manner of adding to statements of present conditions and practice, bits of historical background that give life and meaning to many details. He has a keen sense of the opportunities open to the lawyer for influencing the political and economic life of the nation, but he is not so enthusiastic as to forget the drawbacks and objections to the profession. The book is deserving of a place in the vocational section of all high school libraries.

Art Alphabets and Lettering.

By J. M. Bergling. Cloth, 96 pages. Price, $2,50, net. J. M. Bergling, 1254 Rosedale Ave., Chicago.

This book is the second enlarged edition of a work issued in 1914. It includes 125 different styles of alphabets, studied for especial use by the engraver, engrosser, showcard writer and commercial artist. The historic Roman, Old English, Old German, and French letters are correct and the modern rapid brush letters are interesting. There is also a collection of modern novelties that will appeal to the seeker after the bizarre and unusual, but which have little permanent art value.

The book is beautifully printed and the plates are carefully engraved.

Science of Plant Life.

By Edgar Nelson Transeau. Illustrated by Robert J. Sim. Cloth, 336 pages. Price, $1.48. World Book Company, Yonkers-on-Hudson, New York.

The fundamental aim of this text is to give the student an understanding of the plant as it lives. Environmental factors are considered to make clear the reasons which underlie many agricultural practices. The author so arranges and presents his facts that the idea that the plant is alive and that it has a definite relation to every other living being is unescapable.

The teacher of botany will find an ally in this book. Every page carries its answer to that old query of pupils, "What is the use in studying botany?" Almost all the chapters are preceded by suggestions for laboratory and field work and are followed by practical problems. The exercises are varied enough to provide work for any class and they are adapted to the succession of seasons. The illustrations, the exercises, aud the subjects that receive distinctive treatment are not embroidered on the text; they are made a part of its warp and woof.

Proposed Plan for a School of Trades.

By Charles A. Bennett. Paper, 56 pages. Manual Arts Press, Peoria, Ill.

The author is frank to say in his introduction that he has never visited the country or mingled with the people for whom he was asked to prepare this report. He has, however, suggested a plan that appears entirely feasible and reasonable, and is supported in all its recommendations by facts and figures gleaned from official sources. Quite apart from the intrinsic interest in the local application of the study, the pamphlet is suggestive for American educators in making studies and plans for American trade schools.

PUBLICATIONS.

Handbook of Simplified Spelling. Part I, English Spelling and the Movement to Improve It. Bulletin No. 1 of Vol. 8, April, 1919. Issued by the Simplified Spelling Board, 1 Madison Ave., New York City. This pamphlet discusses the function of spelling, the effect of printing on spelling, the influence of dictionaries, the general progress of the movement, support of the newspapers and magazines, and the part which the present handbook is intended to perform in presenting the various phases of the subject. The pamphlet should be of especial help to teachers of printing in that it suggests the utility of simple spelling in connection with the printing of newspapers, books and magazines.

Courses of Study for the Preparation of Teachers of Manual Arts. Albert F. Siepert. Bulletin No. 37, 1918, U. S. Bureau of Education, Washington, D. C. The pamphlet traces the beginnings of manual arts courses for teachers and offers statistics on the number and character of institutions for the training of teachers, the types of curricula offered and the equipment provided.

Prospectus of the Department of Printing, Boys' Vocational School, St. Joseph, Mo. Prepared by Ralph W. Polk. Printed by the students of the printing department at St. Joseph. The pamphlet has been prepared in answer to requests for information concerning the school printing plant. It describes the equipment, outlines the requirements for the admission of students, and offers a course of study and list of reference books.

Some Advantages of Industrial Training. Bulletin No. 8, United States Training Service, of the Department of Labor, Washington. Prepared under the direction of C. T. Clayton. The Department of Training has been established as a means of fostering the wider adoption of industrial training schools for American industries. Facts and figures have been gathered which reveal a number of causes for low production, among which are lack of training, limitation of equipment, insufficient instruction and retardation of output. The pamphlet takes up causes of low production, opportunity for training, savings thru training, protection to workers, increase of output, and the application of training.

Final Report of the National Army Training Detachments. C. R. Dooley, Educational Director of Vocational Instruction. Published by the Committee on Education and Special Training of the War Department at Washington. The report shows that the Committee operated in 157 different schools and carried on its training in 67 different trades. More than 100,000 trained men had been delivered to the army and 40,000 were ready at the time the armistice was signed in November. The report describes the organization of the Committee on Education and Training, the manner of determining the number of men to be trained in each trade, the object of the training, the selection of men for the training detachments, registration and classification, meeting of army needs, instruction methods, equipment, cooperation with the industries, administration and costs.

Evening and Part-Time Schools in the Textile Industry of the Southern States. Bulletin No. 30, 1919, of the Federal Board of Vocational Education. Issued by the Federal Board at Washington. The pamphlet is a report based on a survey of the needs and possibilities of training for the textile industry and for the establishment of training centers in mill cities. The report which was prepared under the direction of Mr. Roy Dimmitt, will be found of value to mill and school officials.

NOW, ARE THERE ANY QUESTIONS?

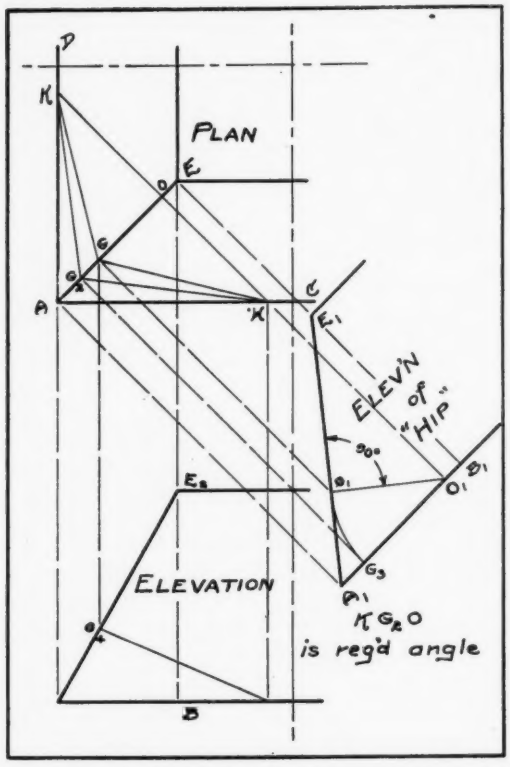
This department is intended for subscribers who have problems which trouble them. The editors will reply to questions, which they feel they can answer, and to other questions they will obtain replies from competent authorities. Letters must invariably be signed with full name of inquirer. All questions are numbered in the order of their receipt. If an answer is desired by mail, a stamped envelope should been closed. The privilege of printing any reply is reserved. Address, Industrial-Arts Magazine, Milwauker, Wis.

Lamp Shade Construction.

To the Editors:

Referring to the article on lamp shades, page 203 of the May issue of your paper, I beg to point out that the solution to the angle at the corner O, Fig. 1, may lead to diffiiculties.

To get the angle for the joint between the pieces of the shade we require a true diagram of a triangular plane with its vertex on the "hip" (corner) AE and the corners of its base on the lines AC and AD and this plane always at right angles to the hip AE.



. Draw plan and elevation of one quarter of the shade in outline only. On an "auxilliary" plane parallel to Ae project the base line A1B1 from the points A and E. Set off at right angles to A1B1 the line B1E1 equal to BE2 (the perpendicular height of the point E). E1A1 is the true length of the hips and the angles E1A1B1 and A1E1B1 are the true angles, at its bottom and top if they are required.

Take any point G1 in E1A1 and draw a perpendicular G1O1. Project G1 to G and O1, to HK. Join GH and GK.

KGH is the plan of the required plane but it is foreshortened. G1O1 is the end view of this plane.

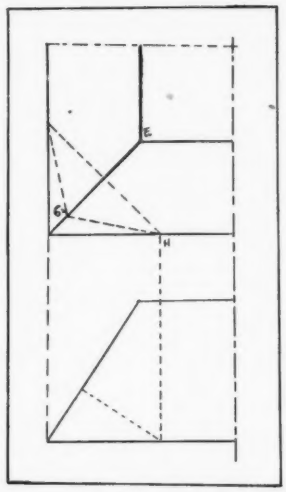
To get the true plane, with compass at O, swing O1G1 down to O1G3. Project G3 to G2. Join G2K and G2H. Then KG2O is the required angle for the joint edge of the shade (angle O, Fig. 1, page 203) and angle KG2H is the angle for an angle iron to fit over the hip.

It is a nice piece of mental imagery to picture in the mind the triangular plane KGH resting on the line KH with its vertex G raised, then to imagine the plane to revolve on the line KH like a hinge (point O1 in the other view) until it is down level (O1G3 its end view) and KG2H its top view giving its true size and shape.

In practice the figures E1A1B1 is often superimposed on the plan using AE as its base. If the height BE2 is known the elevation is unnecessary.—*Franklin J. Tench.*

Comment by Mr. Windoes.

The method of finding the angle suggested by Mr. Tench arrives at practically the same result obtained by my method. He takes a roundabout method and I use a short cut. On the accompanying plate is the method recommended in the May issue of the Magazine. The required angle EG2H is very nearly the same in both cases, so near that one will not require any more fitting in student practice than the other. A ninth grade student can solve a problem as presented in the May magazine but the elaborate auxiliary plane method recommended by



Mr. Tench is mighty confusing. Neither method will give an angle that a student can use without careful fitting in the assembly, but both are very nearly correct.—*Ralph F. Windoes.*

Technical Book Publishers.

952. Q:—Could you give me the names of firms publishing books on the following subjects: rope splicing, practical carpenter and concrete work, gas engineering, farm blacksmithing, giving particular attention to plow shares. —*J. K.*

A:—*Knots and Splices*—Norman W. Henley Publishing Co., 132 Nassau St., New York; Funk & Wagnalls Co., 354 Fourth Ave., New York; E. H. Osborn, Sauk Center, Minn., Munn & Co., Agents, 233 Broadway, New York.

Carpentry—Webb Publishing Co., St. Paul, Minn.; Radford Architectural Co., 178 W. Jackson Blvd., Chicago; New York Book Co., New York; Manual Arts Press Co., Peoria, Ill.; American School of Correspondence, Chicago; Americon Book Co., 100 Washington Square, New York, and 330 E. 22nd St., Chicago.

Concrete Work—H. C. Campbell, Oak Park, Ill.; Norman W. Henley Co., 132 Nassau St., New York; McBride & Co., 31 E. 17th St., New York; Radford Architectural Co., 178 W. Jackson Blvd., Chicago, Concrete Age Publishing Co., Atlanta, Ga., or Concrete, Detroit, Mich.; Macmillan Co., 66 Fifth Ave., New York.

Gas Engineering—F. J. Drake, 1006 S. Michigan Blvd., Chicago; Webb Publishing Co., St. Paul, Minn.; N. W. Henley Publishing Co., New York; Gas Engine Publishing Co., Cincinnati, O.

Farm Blacksmithing—Webb Publishing Co., St. Paul, Minn.; F. J. Drake Co., Chicago.

Mr. Calvin F. McIntosh of Spencer, Ind., has been appointed a member of the Federal Board for Vocational Education. Mr. McIntosh succeeds Mr. Charles A. Greathouse of Indianapolis, who resigned.